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The Institute of British Foundrymen
The Institute of Vitreous Enamellers
The National Ironfounding Employers' Federation
The Welsh Engineers' and Founders' Association
and
The Foundry Trades' Equipment and Supplies Association

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The New Deal.—II

Coming now to the queries referred to in our last issue concerning the N.R.A. policy in the United States, addressed to and answered by some five thousand editors of journals, expressing the state of public opinion in the communities they represented, only 7 per cent. said that public opinion favoured a further increase in the national debt, the negative replies being 89 per cent., while 87 per cent. voted in favour of reducing the number of Government employees. Eighty per cent. voted against the Government fixing selling prices for factory products, and nearly as many against similar fixing of prices of farm products. In fact, the huge majority was against Government interference in farming or manufacturing, or Government setting up in business on its own. No less than 94 per cent. voted against the control of private business enterprise by Government bureaux or officials, and 60 per cent. against Government control of the banks. Seventy per cent. voted against the Federal Government having power to change the purchasing power of the dollar, and rather more against the powers of Government being used to redistribute wealth, such as by taxation. The compulsory membership of trade unions was opposed by 94 per cent., and the same proportion thought that hope of profit is essential to business enterprise. Some 44 per cent. thought the Government should have power to fix minimum wages, and 25 per cent. favoured Government control or regulation of profits in industries other than public utilities. There was an overwhelming majority for making sympathetic strikes and lock-outs illegal, but there was a slight majority, 51 per cent. against 48 per cent., for Government fixing maximum working hours.

The state of opinion revealed is thus definitely more individualist than even Great Britain, which has provision for unemployment insurance and minimum wages, and has generally regulated industry more than the United States. If, then, these replies may be accepted as a fair index to public opinion, how are we to explain the majorities with which the Democratic candidates have been swept into power to strengthen the arm of the President? Can it be that the views are those of the business community and that the elector who is not vocal sees in the New Deal the one hope of straightening out the economic muddle? Time alone can show the answer, but it is more than probable that the President will pursue a middle course rather than steer too far to the left, so that both sections may be satisfied. In the meantime, the recognition by both America and France of the way Britain has tackled her problems is gratifying.

Industrial Reorganisation

In every industry capable of instituting an employers' federation with the object of obtaining an economic return for their goods, a logical examination will reveal that either the majority of firms are operating efficiently and being impeded in their effort by an irresponsible minority, which stays outside, but benefits financially from the co-operative measures undertaken, or the minority are well organised, efficient and profit making, whilst the majority are anxious to eradicate this honourable competition by price fixation which would allow the most inefficient to operate with profit. This in a nutshell portrays the conditions operating in industry taken as a whole to-day, and as a result of much preliminary investigational work, Lord Melchett last Friday, presented to the House of Lords for its first reading an Enabling Bill, which is designed, for the first time in British history to place employers' federations and trade associations on a legalised basis.

At the moment, if an industry requires additional protection from foreign competition, it can make application to the Tariff Commission, and show *inter alia* that as an industry it is operating efficiently. If we have interpreted the preamble to Lord Melchett's Bill correctly, similar conditions will govern the operation of employers' unions. That is, the minority will be able to state a case against the underlying principles of the fundamental clauses in any agreement welding an industry together for its sales, standardisation and research policies. Laws have been enacted in the past governing the conduct of employees' unions, but those of the employers have been merely of a restrictive character, directed in the main against the abuse of monopolies. How this Bill will fare at the hands of the Government, as it is a private member's effort, cannot, of course, be forecast, but if it be correlated with the export position, there is much to be said in its favour, as basically it is related to industrial efficiency. This is due to the fact that once the price of a standard article is fixed, then the firm which shows the highest profits is the one which operates its plants the most efficiently.

This bestowing of political recognition upon employers' federations is no novelty in other

countries. It is the law of the land in Germany, Italy, Russia and Japan. In the first-named country, a firm refusing to co-operate in the work of its appropriate federation, is required by the Government to show cause. Japan's improved position in the export market is credited by many well-informed people to the legal status accorded to the Japanese employers' federations. The American effort at reorganisation is dealt with separately, and the chaotic conditions in that country are undoubtedly due to the inexperience in these matters of the various professors, business men and trade-union leaders. Here a wealth of experience exists which merely requires a reasonable definition of rights and powers by the law. The progress of Lord Melchett's Bill should be followed in its progress with meticulous care by all who are interested in the welfare of British industry.

New Foundry Friendships Formed

YESTERDAY MEETS TO-DAY AT THE "CHESHIRE CHEESE"

At the invitation of the London Branch of the Institute of British Foundrymen, members of the East Midlands Branch attended a joint gathering in London on November 23 and 24. The visitors numbered 30, and included Mr. A. E. Peace (Branch-President), Mr. P. A. Russell (Past Branch-President), and Mr. H. Bunting (Honorary Secretary) of the East Midlands Branch.

Works Visit

The programme opened at mid-day on Friday, when about 110 members of both branches met at Charing Cross Station and travelled down to the works of the Ford Motor Company, Limited, Dagenham, Essex. They were received by Messrs. Meldrum, Burns and Arbuthnot of the Ford Motor Company, Limited, and Mr. Ben Walmsley, C.B.E., who is pig-iron consultant to the Ford Company.

After being photographed and presented with handsome pocket-books, the visitors were split into parties of 20 and conducted round the works. Apart from the foundry, which was the subject of a Paper read before the London Branch on October 3 by Messrs. V. C. Faulkner (Editor of THE FOUNDRY TRADE JOURNAL) and J. N. Burns (plant supervisor) and subsequently published in this Journal, the most interesting feature was the blast furnace. This has been in operation since last June, and is now producing high grade pig-iron at the rate of 500 tons per day.

"Ein Bier Arbend"

On Friday evening the East Midlanders were the guests of the London Branch at an informal dinner held at "Ye Olde Cheshire Cheese" in Fleet Street. This historic hostelry, which dates back to 1667, preserves all its old world atmosphere, and is rich in souvenirs of royalty, peers and personalities, both past and present, who have dined under its roof. A company of 80 sat down to the dinner, for which the "Cheshire Cheese" is famous throughout the world—rump steak, kidney, lark and oyster pudding (weighing 60 lbs.), then pancakes and finally toasted cheese. The natural accompaniment to such a meal in such a place was beer in pint tankards, which was consumed with verve, regularity and precision. An informal concert followed the loyal toast. Song and story, ventriloquial sketches and community singing were all thoroughly enjoyed, and a happy evening was brought to a conclusion with the strains of "Auld Lang Syne."

The Technical Session

Saturday morning was devoted to the presentation of two Papers, and about 75 members of both branches attended the meeting, which was held at Charing Cross Hotel. Mr. A. S. Beech,

(Concluded in next column.)

District Presidents.—No. 12

EAST MIDLANDS BRANCH OF THE INSTITUTE OF BRITISH FOUNDRYMEN

MR. A. E. PEACE, the new President of the East Midlands Branch of the Institute of British Foundrymen, started his career as pupil in the Public Analyst's Laboratory at Gloucester. After a term as assistant chemist with Petters, Limited, Yeovil, he became chemist to the Brightside Foundry Company, Limited, Sheffield. Since 1920 he has been metallurgist and chief chemist to Ley's Malleable Casting Company, Limited, Derby.

MR. A. E. PEACE.

Mr. Peace has visited foundries in the United States and on the Continent, and has at various times presented Papers to the Institute of British Foundrymen and various engineering and metallurgical societies.

(Concluded from previous column.)

President of the London Branch, occupied the chair, supported by Mr. Peace and Mr. Bunting. He introduced Mr. P. A. Russell, who gave a really interesting Paper entitled "Some Experiences in the Manufacture of High-Grade and Alloy Castings." This was illustrated by lantern slides, and a very full discussion followed.

Mr. Beech then invited Mr. Peace to occupy the chair. Mr. Peace expressed his thanks for the honour conferred upon him, and introduced Mr. B. B. Kent, who lectured on the "Enamelling of Cast Iron." His Paper on this comparatively new development in connection with iron castings was very well received, and Mr. F. O. Blackwell supported and amplified the Paper from his own experiences.

Votes of thanks were heartily accorded to Mr. Russell and to Mr. Kent, and Mr. Beech expressed the great pleasure it had given the London Branch to entertain the East Midlands members. In reply Mr. Peace paid a very warm tribute to the hospitality which had been extended to his Branch, and coupled with his remarks an invitation to London members to visit East Midlands next year.

The extended joint meeting, which was an innovation, was an unqualified success, and may be looked upon as a milestone in the history of the Institute, for the strength and solidarity of the whole organisation will be greatly enhanced by the intimate contact between branches provided by gatherings such as this.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Chromium in Malleable Iron

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—I notice in your August 30 issue, page 128, a letter from Mr. Shepherd, of Crane, Limited, regarding chromium in malleable iron. I agree thoroughly with Mr. Shepherd's warning, and would add our caution to his. For the past year and a half, before becoming associated with this organisation, the writer has been in charge of development at the Lakeside Malleable Castings Company, Racine, Wis., and has personally made a great deal of chromium-bearing iron.

I had not heard of any foundrymen "rushing in" to use chromium in their product, as the American foundryman is completely against even a trace of this element in malleable. My experience has been that most of them ridicule the idea, and the writer for sponsoring it.

Mr. Shepherd mentioned tensile strengths up to 30 tons per sq. in. I remember an article by Mr. Shepherd which appeared in your magazine some years ago, dealing with cupola malleable, and from the fact that Mr. Shepherd is making pipe fittings, I assume that he is speaking of cupola iron. However, in the air-furnace I was able to get 40 tons per sq. in. tensile strength, and usually the yield point was over 25 tons per sq. in.

I am enclosing a copy of some of my test results, with the thought that Mr. Shepherd may be interested in them.

I have found chromium-bearing iron especially useful for high-strength, wear-resistant castings. I have also found that small percentages of chromium, in the form of ladle additions, prevents primary graphitisation in heavy sections.

I am, yours, etc.,

REBECCA HALL.

American Foundrymen's Association,
222, W. Adams Street, Chicago, U.S.A.
November 9, 1934.

Foundry Costing

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Although I found the Report on foundry costing in your issue of November 8, to be very interesting, there is one point therein with which I do not agree, and I should like to know the feelings of your other readers on the same point. It was stated that the actual cost of the scrap is equal to the value of the mixture, and examples were given to show how the value of the scrap returned from uniform mixtures gradually decreased. To carry on this procedure means the pricing of scrap after each melt, and also, although the scrap will never be valueless, the price will be low.

The treatment of pricing scrap also spoils the comparisons necessary. To maintain uniformity in the costs for comparison purposes, would it not be better to hold the returned scrap in stock at the market price of scrap (where the market price is lower than the cost)?

Of course, where purchases of scrap were made at different prices, the average would be used for issues and returns from the foundry. The depreciation in the value of the metal returned as scrap would be included, together with the loss in melting, in the price of metal for good castings.—Yours, etc.,

"INTERESTED."

IT IS OFFICIALLY ANNOUNCED that Messrs. J. & J. Dyson, Limited, of Stannington, Sheffield, manufacturers of refractory goods, have obtained a controlling interest in the Camerton Colliery and Brickworks, Cumberland. A new company has been registered under the title of the Camerton Firebrick & Coal Company, Limited.

Non-Ferrous Practice*

By C. A. Howe

The brass foundry demands a fine-grained sand, fairly high in silica, with sufficient clay to give a good bond without entirely destroying its venting properties. Such harmful substances as oxides of iron, alkalies, etc., which reduce its refractoriness should be as low as possible. It is advisable to reduce moisture to the minimum. Molten brass seems to be very adversely affected by steam and moisture; therefore, badly-tempered or over-damp sand can be the cause of numbers of rejected castings.

Sand Preparation

To mix the sand thoroughly and increase its bond, it is placed in a sand mill and treated for about ten minutes. The sand mill is very much like a mortar mill in appearance. The sand is placed in the pan and squeezed underneath the rollers as the mill revolves. By doing so the bonding materials are spread evenly over all the grains of sand, and the bond increased. After leaving the mill, the sand is very close and tough, and if it is possible to pass it through some kind of aerating machine, it will prove beneficial, as the lumps of milled sand are violently broken asunder and, when the operation is complete, a heap of soft, silky, finely-divided sand will result. However, the bond will not be affected, for the sand, having been milled, will still have the bonding materials evenly spread over its grains. Another advantage gained by aerating sand is that the moisture becomes evenly distributed throughout the batch, and does not remain in patches, as is the case with sands not so treated.

Cores

Similar mixtures to those employed for the moulds can be used for coremaking, strengthened with some bonding material such as core-gum flour, etc. However, oil sand is now rapidly finding favour, but it will be found that such sands are not always suitable for every class of non-ferrous alloy.

Boiled linseed oil was one of the first core oils to be used. It is mixed with known proportions of dry silica sand, but nowadays it is thought good practice to add a small proportion of naturally-bonded sand to the sharp sand. After the mixture has been milled, a strong green bond is obtained. Cores made from this sand can be handled as easily as those made from ordinary core sand, and there is no need to provide expensive drying facilities, yet at the same time the sand possesses all the advantages obtained from a linseed-oil bond.

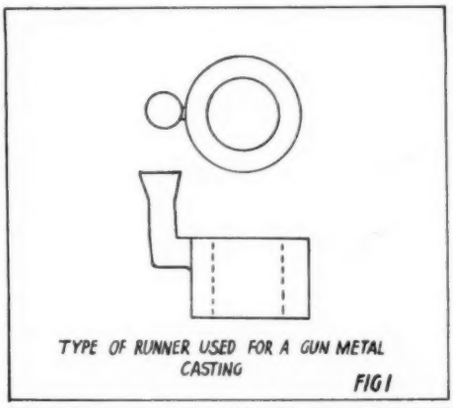
Gunmetal

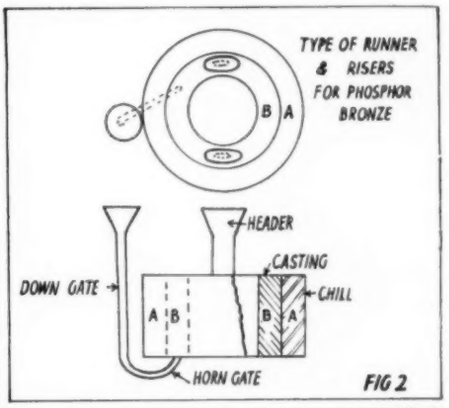
At one time the term covered the alloys of copper and tin used for ordnance manufacture, but now it includes the engineering alloys having a base of copper, with varying additions of tin and zinc. It is common to add small percentages of lead to the alloy, either to cheapen it, to increase its machining properties, or to make it more fitted to withstand pressure. There is no doubt that the presence of lead permits of the use of higher cutting speeds in the machine shop, but as to making gunmetal less liable to porosity, it is a moot point. In fact, it may have the opposite effect, if it reaches 2 per cent. It is considered, that as the alloy sets, lead, which largely retains its own identity and does not enter into chemical combination with the alloy, will be squeezed into the small crevices left between the interlocked crystals, so producing a non-porous casting. But it must also be remembered that lead has a greater specific gravity than the remainder of the alloy, and segregation will occur. If the casting is of varying section, the lead will settle during solidification, leaving porous spots at the junction of thick and thin sections. From personally-conducted experiments it has been possible to obtain pressure-tight castings from straight copper-tin-zinc alloys, but on the introduction of lead porosity immediately became apparent.

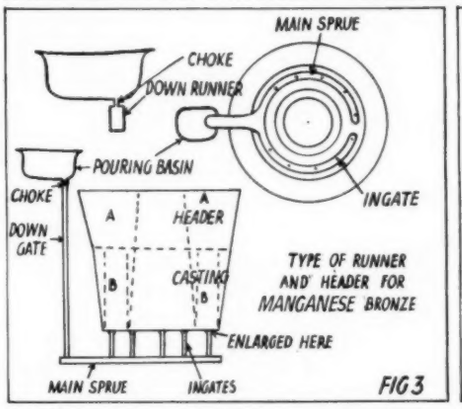
However, different foundrymen have varying experiences, and one cannot be too dogmatic in speaking of foundry practice. As a general rule, gunmetal is one of the easiest alloys to cast. But care must be taken to obtain good results.

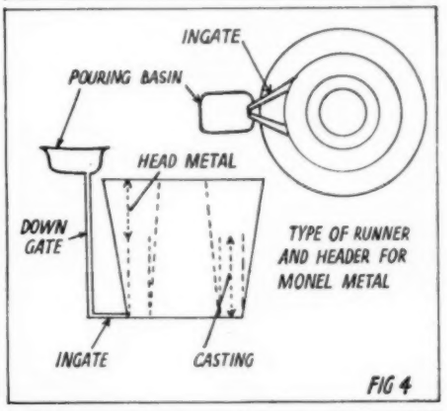
It is difficult to produce a really sound piece of work, unless the casting is gated in such a manner as to counteract the tendency to minute draw holes and adequately feed the casting. Unfortunately, the drawn metal is not apparent to the naked eye and does not show up until the casting is tested under pressure.

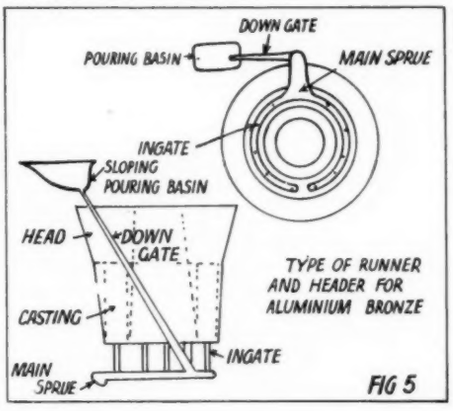
In spite of this tendency to draw, experience has shown that placing heavy feeder heads over heavy sections in a gunmetal casting is not always a remedy when making copper-tin-zinc alloys. As a matter of fact the reverse seems to be the case, for porous spots, pin holes, and draws are often found under the headers when they are removed. Although setting out the principle that risers should be dispensed with whenever practicable, the complicated design of some castings renders this impossible. Even then, if it is possible to introduce a second ingate, it will be far better than a riser. The feeding should be done through the down runner and ingate, which should be well designed for this purpose. This design must incorporate the principle that the casting sets first, then the ingate, down runner and basin, in that order, thus feeding takes place until the last moment. The ingate should, as nearly as possible, approximate the section of the casting to which it is attached, and the downgate be sufficiently large to keep the metal in it liquid, as long as that in the ingate. Increasing the height of the down runner will give extra pressure if required. The cold mould will have a chilling effect upon the molten metal as it collects therein, but the

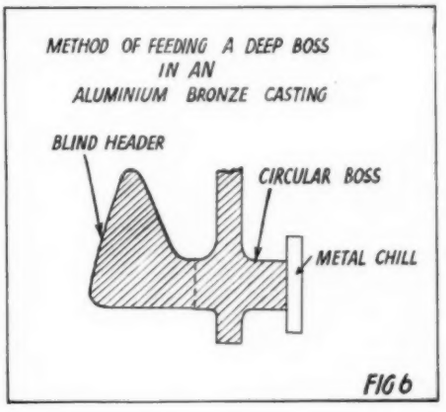












* A Paper read before the Junior Section of the Lancashire Branch of the Institute of British Foundrymen, Mr. A. L. Key presiding.

runners will be considerably heated by the metal as it passes through them. Thus everything should be in favour of the metal in the mould setting first, solidification starting first at the points furthest from the runner, and so on, till it finally reaches the pouring basin. If this happens, a correctly-fed casting should result. Gunmetals are cleaner casting metals than cast iron, allowing for the use of larger downgates without the fear of resultant dirty castings. However, when making large gunmetal castings, which have to be machined all over, it will be found good policy to keep the pouring basin full of metal when casting, or else dirt will find its way into the mould.

The addition of lead to the alloy complicates matters somewhat, and different casting methods become necessary. Lead readily oxidises at the temperature of molten gunmetal. If a crucible of gunmetal containing a fairly high percentage of lead is watched closely, a blackish film will be seen to form upon its surface. This is never seen upon a copper-tin-zinc gunmetal, and so must be due to the presence of lead. If the film be skimmed off, another forms immediately. It is obvious that, if an alloy oxidises easily in a quiescent state, it must do so far more readily when it is agitated. This is actually the case, and during casting the lead oxide gathers into patches of dross, which, if not prevented from entering the mould, will cause unsightly marks when the casting comes to be machined. To prevent the dross from entering the mould, it is advisable to make the ingates of such a size that the pouring basin can be kept full of metal during teeming. This should cause the dross to float on the surface of the metal, and prevent it from entering the mould with the good metal. The best way to gate the mould is at the lowest point. It will not be possible to feed the casting through such small ingates, so some other provision will have to be made. Fairly heavy headers should be used, placed, if possible, over the hot spots in the mould, that is, where the ingates enter. Different casting temperatures are also advisable for the different compositions. The casting range for straight gunmetal varies between 1,140 and 1,180 deg. C., but that for a leaded gunmetal somewhere about 1,100 deg. C.

Every composition requires a different pouring temperature, and it is only by long experience, and the maintenance of accurate records over a long period, that the best temperature can be arrived at for casting certain classes of work. Gunmetal castings can be readily made in green-sand moulds, but for large work it is best to stove the moulds. It is the practice to make numbers of small castings in the same moulding box, but when this is done, care should be taken not to make the ingates too massive, or else the castings may feed the runner instead of the reverse way. Oil-sand cores should be used with discretion, for they are not invariably satisfactory.

Brass and Brazing Metals

Runners similar to those in use for gunmetal can be used for brass, but when making thin castings of large area, it is advisable to place flow-off risers from the edge of the casting. This is not for feeding purposes, but to allow the air to escape freely from the mould; otherwise it will act as a cushion and prevent the metal from completely filling it.

Green-sand moulds can be used for brass, but for large thin castings it is preferable to dry them. Feeders should be placed on heavy sections, but chills can be used to advantage at positions where it is difficult to place a riser. Oil-sand cores can be used, but when the casting is large and of very thin section, care should be taken, as it is apt to sag and distort when green, and may cause a defective casting if not carefully checked.

Manganese Bronze

Although manganese bronze is occasionally used, the alloys in general use to-day, known as manganese bronze, are not really bronzes, but brasses, so the term manganese brass would seem to be more suitable. There are many different compositions in use, but the basis of most of them is 60-40 brass, with varying small additions of manganese, aluminium, iron and tin. The addition of manganese has a marked effect upon the alloy, as it greatly increases its tensile strength and elongation, producing a metal nearly as strong as steel.

The alloy is now no longer easy to cast, as its liquid shrinkage has increased so much that elaborate precautions have to be taken in order to produce sound undrawn castings. The molten alloy also oxidises so readily that the least turbulence during casting is sufficient to cause defects. To counteract the liquid shrinkage it is necessary to place massive feeder heads over heavy sections of the castings. These feeders are very similar in design to those used for steel castings. To help the feeding it is best to stop pouring as soon as the metal comes up level with the top of the moulding box—plug the pouring basin—and then pour in hot metal through the headers. The use of these heavy feeder heads may seem rather wasteful and expensive, as they often more than double the weight of a casting. Actually, it would be impossible to produce a sound casting without them. Chills and denseners can be used to great advantage in conjunction with these headers, and can be employed at heavy sections where it is extremely difficult to place feeders. Chills should be heavy enough to solidify the metal in their vicinity as rapidly as that in the thinner sections of the castings surrounding them. The metal in the heavy section can then be fed as long as liquid. If chills are not so placed visible draw holes will be noticed at these spots as soon as the castings are removed from the sand.

Great care should be taken when deciding what kind of runner is suitable for these castings, owing to the free oxidation of the metal. Unless the design and position are well disposed the castings will be full of dross. Bottom pouring will be found to give the best results. The area of the downgate should be considerably smaller than the main sprue into which it enters, and the ingate still larger. It is also good practice to make the outlet from the pouring basin smaller in area than the downgate itself, and so prevent undue friction as the metal flows through. It will be thus seen that the area of the runner increases until it reaches the mould. This helps to relieve the down pressure of the metal pouring in from the basin, and prevents a squirting action taking place at the entrance to the mould, as would occur if the ingate were smaller than the down runner. Slow pouring will give the best results, and a down runner $\frac{3}{4}$ in. dia. will be found quite large enough to run a fairly heavy casting of over 10 cwts. As the metal enters the ingate it should collect quietly at the bottom of the mould, and slowly fill it without any bubbling or squirting from a badly designed runner, badly vented mould or core.

Any dross formed during casting will stick to the face of the mould. Consequently, when dealing with this alloy, it is policy to increase the usual machining allowance, to ensure that these defects will machine out. In some instances, $\frac{1}{4}$ in. to $\frac{3}{8}$ in. machining allowance will not be found excessive.

The casting temperature of the alloy varies between 960 and 1,000 deg. C., according to the class of casting being made, section, etc.

Bronzes

These were originally alloys of copper and tin, but now there are alloys in existence known as bronzes, that have no tin in their composition. Bronzes, composed solely of copper and tin are not extensively used in engineering, but the alloy is still largely used for casting church bells. Phosphor-bronzes which are copper-tin alloys to which varying percentages of phosphorus are added—after gunmetal—form the bulk of non-ferrous work.

When making gear wheels, bearings, etc., phosphor-bronze presents but little difficulty to the founder, but when he has to make castings which have to withstand high pressure after having been machined all over, troubles are imminent. Porosity is apt to occur no matter how carefully the moulder tries to prevent it. If, when manufacturing gear-wheel blanks, it is possible to chill the periphery of the wheel, a far superior article will result, for a sound, close-grained, hard-wearing metal will be produced where the teeth are to be cut. In such a case it is best to bottom-pour the mould through a horn gate, which should enter the mould at a tangent and feed the casting through moderately-sized risers. Bearings can be fed from the runners or risers, according to the design of the casting.

Pressure castings present much greater difficulty; so much, in fact, that every casting has to be treated individually, and no hard-and-fast rule can be enunciated. Molten bronze, however, absorbs gases, and the higher the temperature to which the metal is raised, the greater will be the gas absorption. If it is possible to set the metal rapidly, as in a metal mould, or to apply great pressure, it is possible to keep the gases in solution, and apparently they are not then detrimental to the casting.

In addition to gases being absorbed during the melting of the alloy, if a green-sand mould is being used, they can be gathered from this during casting.

Phosphor Bronze

Phosphor-bronze castings are often pressure-tight in a rough state, but extremely porous after the skin has been removed, because the casting is covered with a skin of chilled metal in which the gases have been retained in solution. The cold face of the mould caused this chilling action. However, the core having taken longer to cool, allows the gases to come out of solution, making it spongy, which only becomes apparent when the outer skin of chilled metal has been removed. It would seem from the foregoing that a chilled or semi-chilled mould seems called for when dealing with phosphor-bronze pressure castings.

It will be found that top-pouring will be best for such work with heavy chills placed at all irregular sections, in order to cool the metal as rapidly as possible at such places. Hot spots should be avoided and risers are not always an asset. To obtain the best results from phosphor bronze, dry-sand moulds are essential. This will prevent the molten metal absorbing gases from moisture in the mould. It also ensures the production of a better-looking casting, because phosphor bronze is extremely fluid when molten, and will find its way between the grains of sand in a green-sand mould. Even when the moulds are dry, this will occur if the alloy is poured at a high temperature, and when the casting is removed from the mould it will appear a shapeless mass of sand which will be found very difficult to fettle. This eating into the sand is liable to cause internal defects in the casting, for the metal that works out through the grains of sand is not always replaced through the risers. Runners and risers should be moderate in size. Chills and denseners should be used whenever possible.

Casting temperature will vary according to the composition of the alloy. It will lie between 1,040 to 1,140 deg. C., and the higher the tin or phosphorus content the lower will be the casting temperature. The appearance of the head after casting will serve as a good guide as to whether the correct temperature has been used.

If beads of tin-sweat form on the surface, it points to the temperature having been too high, but if the surface of the head sinks perceptibly, forming a funnel, the temperature has either been too low or there has been excessive gas absorption. If the correct temperature has been

used, the surface of the head should be slightly rough and corrugated, only a slight sink occurring and no tin-sweat should form.

Aluminium Bronze

This is not a bronze in the true sense of the word, not being an alloy of copper and tin, but of copper and aluminium. The most satisfactory alloys contain up to 10 per cent. of aluminium, but when this percentage is exceeded brittleness ensues. However, aluminium containing from 5 to 10 per cent. of copper makes a very serviceable alloy though it does not enter into the category of an aluminium bronze, but is classed with the aluminium alloys. Aluminium bronze is very strong and is used extensively for acid-resisting purposes. It will be found that small percentages of nickel and iron will greatly improve the latter property. Aluminium bronze is one of the most difficult alloys in the foundry to handle successfully. It must be treated in a very similar manner to manganese bronze, but needs even greater care. To counteract liquid shrinkage heavy headers and chills have to be used. When a heavy section is situated at the bottom of the mould and cannot be fed from the top feeder, it will be found advantageous to place a heavy feeder reservoir near it, as shown in Fig. 6. The header need not be brought to the surface of the moulding box. It can consist of spherical hollows formed in the mould of sufficient size to allow the metal in it to remain fluid a little longer than that in the section of the casting to which it is attached.

Molten aluminium bronze oxidises in the atmosphere even more readily than manganese bronze, and forms a whitish dross which is extremely difficult to eliminate. The oxidation is greatly increased if the alloy is at all agitated, and so, as before, the slightest turbulence during casting results in the formation of dross which collects in the mould much to the detriment of the casting.

When making sand moulds by ordinary methods it is advisable to pour the mould from the bottom. The down runner should be small in area to keep the pouring basin full of metal during casting. Instead of placing the down gate in the usual vertical position, it will be found best if it is possible to place it at an angle of, say, 30 deg. It is also advisable to taper the down runner from the pouring basin, making it gradually larger as it gets to the bottom. The ingate should be large enough for the metal to flow through without any congestion or impediment. The use of sloping down gates avoids the violent churning and mixing action that would be caused by the metal dropping from a height through a vertical down runner, and by gradually opening out the gate, the metal enters the mould without the violent rushing or squirting that would result with a different design. When teeming the mould, the crucible should be kept as near the pouring basin as possible. It is not advisable to pour hot metal into the headers for feeding purposes, as is done with manganese bronze, because dross is liable to be carried back into the mould when doing so.

This alloy has an extremely close, fine, and silky fracture, and would seem to be eminently suited to pressure castings. This is not so, for the presence of oxide in the alloy makes it very difficult to obtain sound castings for such purposes. The film of oxide forms a distinct flaw right through a section in the metal, and it is here that the casting will leak when subjected to the pressure test. Moulds and cores for aluminium bronze castings should be thoroughly dried and vented. Neither should it be rammed too hard, else the metal will not lie on the surface but instead become agitated with fatal results. Oil sand cores do not give satisfactory results.

German Silver

German silver is an alloy which is very troublesome to deal with if not properly understood. It is a complex alloy, and varies greatly in its composition. In most instances copper and nickel form the base of the alloy, with varying smaller additions of zinc, iron, lead and sometimes tin. In one respect it is very similar to silver, for it absorbs gas when molten, and exudes it again during solidification. The gas is possibly oxygen. It will be found that, if some strong deoxidising agent is not used immediately before casting, curious results will be obtained. The metal in the pouring basin and riser will begin to swell, finally becoming more than twice the original volume. It will be realised that much of the metal has been squeezed out of the casting and that it will be very porous in consequence. Even under the best conditions, and with the metal properly deoxidised, it will be found difficult to obtain sound non-porous castings.

Fairly heavy headers should be placed over heavy sections, and runners very similar to those used for gunmetal will be found suitable. Chills can be used to advantage, and it would seem that the more rapidly the metal is set, the better will be the final result. The pouring temperature will vary according to composition, but it will be found that the best result will be obtained when the metal is cast hot, and the temperature will often be over 1,200 deg. C. Green-sand moulds are suitable for German silver, and if it is possible to use green-sand cores, it will be found advantageous.

Nickel and Monel Metal

These have melting points as high, if not higher than cast iron. Monel metal is a natural alloy of nickel, copper, iron, etc., being mined as their ores. It is also made artificially, the different metals being allowed to give similar compositions. These alloys are used extensively for acid-resisting purposes, especially at high temperatures, being far the most generally satisfactory of the non-ferrous alloys for this purpose.

These alloys are liable to pick up carbon at high temperatures. If melted in a graphite crucible, the temperature should not be raised too high, nor the metal kept too long in contact with the crucible, or else it will absorb the graphite therefrom, with amazing results. When the casting is machined, instead of a bright-steel-like metal, a coarse crystalline structure will be revealed. It crumbles in front of the tool and is totally unusable. A fireclay crucible similar to that used for steel melting would be more suitable for this class of work.

Nickel and Monel metal also absorb gas when molten. This will appear in the form of pinholes in the casting, if not eliminated before the metal is cast. Degasifying agents, such as silicon, manganese dioxide and magnesium will be found very useful in this respect.

The metals should be treated very much like steel for moulding purposes. Small runners and heavy headers are essential, and for large castings bottom pouring will give the best results. The moulds should be dried and oil sand can be used both for mould and cores if so desired.

White Metal

The non-ferrous foundry is often called upon to make white-metal castings. The alloys vary greatly in composition. Some have a tin base to which varying percentages of copper, antimony, and occasionally lead, are added. The base of others is lead, and here again copper, antimony and tin enter into the composition of the alloy, and sometimes zinc and bismuth. All these alloys have low melting points, and are very fluid when molten. Lead-base alloys make much dross and small ingates should be used for them, otherwise runners similar to those used for gunmetal are suitable. Headers can be placed over heavy sections.

The sand used for the moulds should be as fine as possible and rammed tightly, or else the metal will find its way between the grains, making an unsightly casting. Moulds should be dried for castings of heavy section. The pouring temperature should be as low as possible. A good guide to the correct temperature is to poke a piece of white paper or green wood into the metal. When it is just scorched it is time to cast. White metals cast well in metal dies, a method which produces a far superior article than that obtained by sand casting. Both gravity-pressure methods of die casting can be employed with equally good results. Consequently, if an order be large enough to justify the expense it is well to use metal dies in carrying it out. Machining will thus be reduced to a minimum or entirely eliminated, the finish of the casting will be infinitely better, and the metal itself will benefit, for segregation will be prevented and it will have a fine close-grained fracture, free from draw holes.

DISCUSSION

During the discussion which followed the Paper, MR. HOWE suggested as a base for chills, that their section should be half that of the section to be chilled. MR. N. COOKE, the Branch-President, said that oil-sand cores, washed with a mixture of plumbago and fireclay, were suited for use with phosphor-bronze castings.

Methods of Sampling Dust

THE THERMAL PRECIPITATOR

In the course of a Paper entitled "Recent Developments in Methods of Sampling Dust" read by DR. JANET W. MATTHEWS and DR. H. V. A. BRISCOE before a meeting of the Institution of Mining and Metallurgy, which was held in London recently, the authors gave an account of work on dust-sampling done under the auspices of the Industrial Pulmonary Disease Committee of the Medical Research Council, and emphasised the need for the development of new methods for both fundamental research and routine dust estimation.

The authors described the standard laboratory methods represented by the ultramicroscope, sedimentation cells and a photographic Aitken apparatus. The two former were used to test in the laboratory the efficiencies of existing dust-sampling instruments, widely used in various parts of the world. Clouds of flint dust, containing particles of the same size-frequency as found in industry, were used in the course of tests on the Greenburg-Smith impinger, a circular konimeter and the Owens jet dust-counter. As none of these instruments was found suitable for fundamental work, a new instrument, the thermal precipitator, developed by Prof. R. Whytlaw-Gray and Dr. R. Lomax for estimating ordinary atmospheric pollution, has been adapted for the long-period sampling of dusts. As a result of a preliminary study of the physical principles of thermal precipitation, useful modifications to the original instrument have been made. The final model enables the dust from a measured volume of air, slowly streaming past an electrically-heated wire, to be deposited uniformly on cover-slips in a way convenient for mounting and subsequent counting and measurement of the deposited particles. It is practically 100 per cent. efficient for all particles of likely pathogenic importance, and samples can be taken over periods of time from ten minutes to two hours or more. It is capable of dealing with wide ranges of concentration.

The thermal precipitator satisfies most of the requirements of a standard instrument, both for fundamental and comparative work; it yields accurate information about the numbers of particles and their size-frequency and, to a certain extent, about their shape. For a fundamental investigation, it is also necessary that the nature of the particles should be determined quantitatively. The thermal precipitator records can be mounted in a way suitable for petrological examination, but, owing to the difficulty of identifying the nature of particles below about 2μ in diameter, this part of the problem still awaits solution.

XUM

A Novel Continuous Shot-Blast Machine

On a recent occasion, in Manchester, we visited the extensive works of St. George's Engineers, Limited, Ordsall Lane, Trafford Bridge, Manchester, 5, with the object of inspecting a continuous blast cleaning machine which to our mind has been erroneously called a "sand-blast barrel." In the first place, it is specially designed for using "chilled-iron" grit and secondly the barrel gives no "barrelling" effect, but is essentially a contrivance for mechanically exposing every part of the casting or forging to be cleaned to the effect of the shot-blast, associated with automatic loading and discharge to achieve a continuous output. Actually, castings which have been through this system, though scrupulously clean, still retain the sharp edges and tiny flashes not usually associated with a tumbling barrel. The new machine is shown in Fig. 1, from which it will be seen that the castings enter the system at A either by hand charging or by spilling off from a band or other conveyor. They enter the barrel B, and a series of brackets attached to the barrel, which rotates but two or three times a minute, carry the castings some distance for the lowermost position and cause them to turn over and fall in behind, exposing a new surface to the action of the blast. Attention is drawn to the angle of the hose and nozzles, two of which are shown, but more may be incorporated. As they are inclined to play upon the deepest portion of the receptacle, which is bound once operations have started, to be covered by the parts to be cleaned, and the only means by which the perforated shell could be abraded is by some "idiot" starting to blast before charging up. It will be appreciated from a study of Fig. 1 that the speed of charging regulates the speed of discharge, which latter is so arranged that it is the easiest matter to incorporate a belt conveyor for transporting the castings to the sorting or other department. A triple rubber curtain at both entrance and exit completely inhibits the projection of grains of grit, a feature reinforced by the negative pressure existing within the drum.

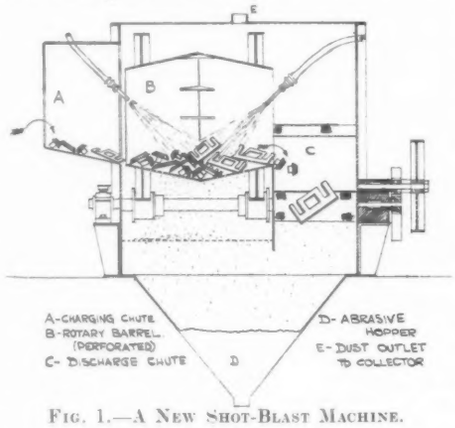


FIG. 1.—A NEW SHOT-BLAST MACHINE.

So far as the mixture of "steel" grit and dust is concerned, it drops through the perforations of the drum into the outer casing, where gravity feeds it into the boot of a bucket and belt elevator. At its maximum height, the bucket discharges into a pipe, leading into a closed cylindrical chamber, at the top of which is centrally disposed an inverted cone. From this chamber a suction fan carries away the dust, whilst the actual grit falls to the bottom to be again pressure-fed to the nozzles. The power required for the rotation of the various sizes of drums is of a modest order, whilst that required for the actual blasting is comparable with normal practice. The plant is substantially constructed by a firm obviously possessing a maximum of facilities for the execution of this type of work. The design is the subject of a patent application by the company and Mr. F. W. Wilson, who has recently been accorded a seat on the directorate of the company.

An Intricate Machine Tool Casting

Because of the Machine Tool Exhibition, much discussion has taken place in this office as to the progress recently registered by the foundries catering for that industry. Whilst in general there has been more regard for foundry technique in many of the designs, there is still room for improvement and the according of facilities akin to those apparently granted so readily to the "weldings" department. From Fig. 1 it will be seen that certain machine tools are still of necessity distinctly complicated. It is one of a line made in the foundries of Messrs. The Horseley Bridge & Thos. Piggott, Limited, of Tipton. The casting is of $\frac{3}{4}$-in. section and weighs $5\frac{1}{2}$ tons. The width at the base is 8 ft. 4 in. and the height 8 ft. 6 in. The largest oil-sand core weighed 2 tons 5 cwts. and Glyso was used as the bonding medium. The casting, which is illustrated in Fig. 2, was braced internally with a series of radial webs. The fettling was expeditiously carried out as the cores were easily removed.

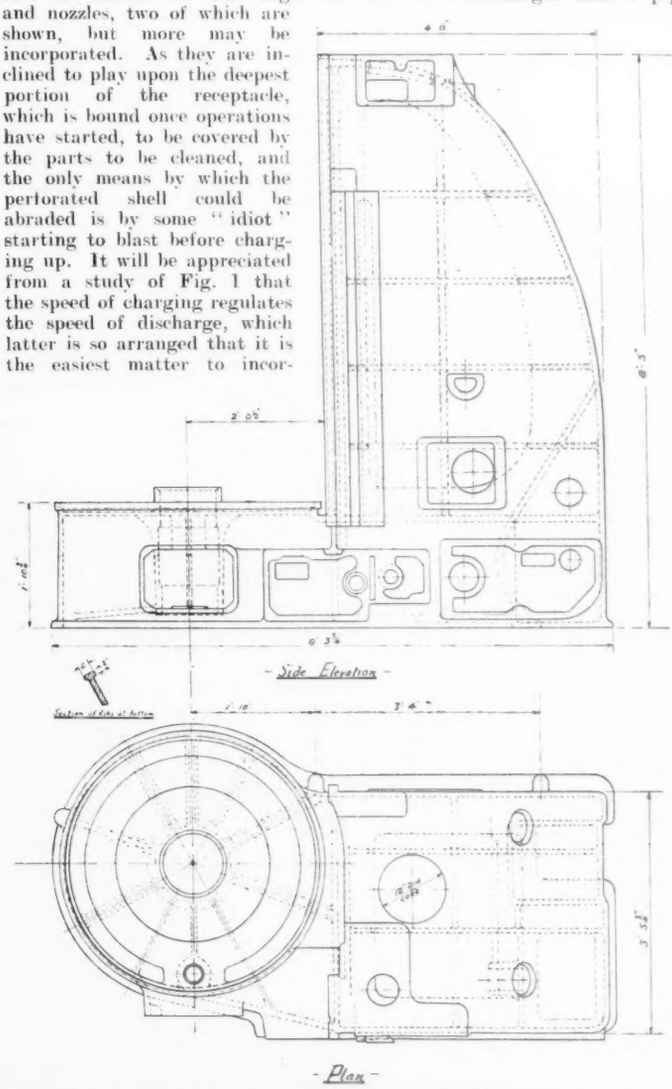


FIG. 1.—AN INTRICATE MACHINE-TOOL CASTING, THE FORM OF WHICH IS SHOWN IN FIG. 2.

FIG. 2.—THE FINISHED CASTING SHOWN IN OUTLINE IN FIG. 1, MADE BY HORSELEY BRIDGE & THOMAS PIGGOTT, LIMITED.

Foundry Methods from an Engineer's Point of View*

By F. Williams (Works Manager, Markham and Company, Limited, Chesterfield)

Members of the Sheffield and East Midlands Branches of the Institute of British Foundrymen, jointly, visited the works of Markham & Company, Limited, at Chesterfield, on the second meeting of the session, when there was a large muster. The visitors were shown over the various shops, where they inspected numerous castings and engineering jobs and machinery.

After tea in the works canteen, at the invitation of the firm, the party adjourned to the Station Hotel, Chesterfield, where Mr. F. Williams, works manager of Markham & Company, Limited, gave a Paper, entitled "Foundry Methods from the Engineer's Point of View." The Paper was illustrated with lantern slides.

MR. J. E. HURST, President of the Sheffield Branch, who presided, said that Mr. Williams had not only given up his afternoon to show them round the works, but was providing them with intellectual entertainment.

Mr. Williams' Lecture.

The subject will be considered under two headings, viz.:—(1) Methods affecting the quality of castings; and (2) methods affecting the costs of castings. Under the first heading, the author writes as a user of castings, and consequently as a sufferer from the methods, or lack of methods, employed in foundries, for in the course of a year he builds into finished products some thousands of tons of castings in iron, steel and the non-ferrous metals, and he now proposes to draw attention to very common faults which are directly due to imperfect methods of production, but towards remedying which little progress appears to be made.

In most castings holes are required to take bolts, shafts, etc., and superficially it is considered cheaper to core these holes rather than machine them out of the solid. Personal opinion is that, so faulty is the general run of this cored work, that it actually would be cheaper to cast the holes solid and machine them out. Yet, if asked to cast them solid, the foundry in most cases found another trouble arose, to which reference will be made later.

Quite recently the author had a number of castings with this coring fault, the cores in the worst case being 1½ in. out of centre, when offered up to mating holes. The correction of this trouble cost him a fortnight's work on a big horizontal borer.

Again, ill-placed body cores, or cores which, due to not being firmly held, have moved during pouring of the casting, result in castings which have to be corrected in some way, but always with additional cost. Bores of holes may not clean up on machining, and therefore they have to be bushed, or the casting scrapped.

Consider also the departure of the casting from the desired shape, due to stresses set up during cooling. These departures, in the main, follow clearly defined and well-known lines, yet very few foundries appear to provide against them, judged by the castings they deliver. What is the result? Castings which will not machine up to the desired dimensions. In the case of iron castings, this usually means scrapping them, but with steel castings, one generally gets over the trouble by heating the casting and setting it under a press or by using the steelfounder's best friend, the electric-welding set.

The Case of Steel Castings

If a pattern be sent to the steelfounder and made exactly to his instructions, a visit to his works after reception will reveal that in 99 times out of 100 he will add a ¼ in. of thickness to the back of the flange, just for luck. Or he will probably double the machining allowances to which he agreed originally. In either case the customer's luck is out, because he must pay for increased weight.

Drawn Castings

The cause of drawn castings is well known, but a visit to any machine shop will provide instances where no intelligent anticipation has been shown. This is the trouble to which reference was made earlier, when considering the coring of holes in bosses. If they be cast solid, in most cases a spongy centre will be encountered which is very troublesome during machining. An example of this defect is provided by a large ring recently received where inadequate provision against "draw" had been made. The result was a very faulty casting which had to be repaired by electric welding. This was aggravating enough in itself, but it was further intensified by the fact that the fault did not show up until a stage in the machining had been reached at which it was not advisable to remove the casting from the machine while doing the welding. The welding took two double shifts, and the use of the machine, a big vertical mill with a high machine-hour rate, was lost for this time. An occurrence of this kind seriously dislocates one's planned programme and creates anything but a kindly attitude towards the foundry. The cause of the defect is quite well known and generally can be prevented by the use of chills or proper feeding.

Hydraulic Castings

Castings for hydraulic work often give unnecessary trouble when put under test. It is no unusual thing to see leakage caused by inconsiderate use of chaplets, or to see porous patches where use of a chill would have densened the metal.

The production of castings with clean faces when machined is another matter calling for increased attention. Many castings are scrapped during the machining stage, and it is interesting to speculate what percentage of castings not to be machined contain thereby undisclosed flaws, which the performance of this operation would bring to light.

Take the removal of large runners and risers from iron castings. To use a common expression, "more brawn than brains" is often used here. I have seen castings spoiled by sheer carelessness over the work, by someone taking a heavy hammer and while the casting was still hot, knocking the runner off. This almost always tears a piece out of the casting at the runner junction. It may be said this is hardly credible, but actually it is within my personal experience.

The above outlines the most common faults found in the production of castings. They arise not from lack of any special scientific knowledge, but because sufficient attention has not been paid to previous experience. These faults are common; in fact very common, and any young moulder just completing his apprenticeship knows of them.

If one considers the scrap produced in foundries doing general work, it will be found that the major part consists of apparently simple work. It is the appearance of simplicity which is the beginning of the trouble. The work is handled in a routine manner, and rarely receives the consideration due. Now in general work of a non-repetitive nature it is submitted that each piece to be produced is a problem by itself, and must be considered as such to yield the best results. In larger and more special work, every aspect of the casting is considered with the result that the scrap percentage in this class is a low one. Let the founder apply these methods to the whole of the work and it is reasonably certain that they would obtain surprising results. What is wanted is less post-mortem and more ante-natal examination. In recent times much trade has been lost to foundries through the fabrication in welded steel of parts formerly cast. Not all this loss could have been avoided, but some of it certainly could, had users felt that the foundryman fully appreciated their requirements and were ready to give them the quality of castings desired.

Foundry Costs

The following remarks do not apply to special-purpose foundries, but only to those doing contract work, and in this case from the angle of a producer of iron and non-ferrous castings. During recent years, outstanding improvements in production costs have been seen in engineering shops, but during the same time, the relative improvement in the foundry has been poor. The foundry does not offer perhaps quite the same scope in this direction, but nevertheless it is apparent that the moulders' manual dexterity has not improved to the same extent as that of other branches of the engineering trade. This is a matter of supreme importance since wages are the largest single item in costs.

In the first part of this Paper it was submitted that improvement in the soundness of castings would result from more consideration of each individual piece, and it is a personal view that reduction in costs can be achieved by similar methods.

One of the difficulties to be met is that the moulder is probably the most conservative of all workmen, and new ideas and methods are not as a rule accepted very readily. If a practice were made of studying castings after fettling, valuable information may be obtained as to the minimum amount of work that must be done in moulding. Study the work, operation by operation, setting out beforehand carefully-estimated times for each, check them against actual performances and soon there will be reliable data as a basis on which to bring about the desired reductions.

If a founder does this his time will be fully occupied and life will be rather strenuous; nevertheless, it is the main line along which improvement can come. There are other things which can help, and it is thought that more could be done in the way of mechanising some of the work done in a foundry.

Although the above remarks criticise the founders' work, the author gives the assurance that the foundry has always absorbed a very large part of his interest, and that they have been made in no unkind spirit. Rather, he hopes that they will cause everybody to give increased attention to matters so vital to the welfare of the foundryman and his work.

DISCUSSION

Faulty Steel Castings

MR. C. D. POLLARD said that in opening the discussion he felt at a little disadvantage in answering some of Mr. Williams' criticisms, because he had at times been responsible for the supply of quite a number of steel castings for Mr. Williams' works. However, he had had nothing to do with any of the castings they had seen in the shop that day or any of those shown on the slides. In the first slide, which showed the drum casting, where Mr. Williams complained about defects opposite the ribs at the right-angle sections, had Mr. Williams considered putting what might be termed cores of inertia at the junction where the supporting ribs met the two flanges of the casting? In his opinion, cores at that position would eliminate the majority of the defects.

* A Paper read before a joint meeting of the Sheffield and East Midlands Branch of the Institute of British Foundrymen. Mr. J. E. Hurst presiding.

Mr. Williams had emphasised core holes being out of position. They knew that this happened in the best-organised foundries, but at the speaker's works they tried to eliminate that as far as possible by always having patternmakers in the foundry definitely responsible for the setting of cores. They did not hold the foreman moulder solely responsible for the setting of cores, which might be a difficult thing to explain to, and yet be properly understood by, a meeting of foundrymen. They had maintained over a good many years that a patternmaker or patternmakers in a foundry were a more sure means to obtain correct coring-up than if it were left to the moulders. In this matter of inaccuracy they must not forget the human element. In a mechanised foundry the human element and resultant troubles were almost eliminated, but in jobbing foundries it must be recognised that it came in, and when the production of a particular casting lasted for days, sometimes weeks, it was most difficult for any man responsible for a foundry to couple up every operation and eliminate the human element on the job. That was one of the problems that was always with them. With regard to the deformation of castings, he contended that the man who delivered castings into the machine shops with such deformations as they had seen was not doing his job.

Foundry Costs

With regard to costs, occasionally money was lost on castings that his firm delivered, and complaints were made that the cost of production was too high. He could quite see now why some of their competitors were delivering castings cheaper than they could produce them.

He must say how much he had appreciated the manner in which Mr. Williams had wholeheartedly gone for the foundryman. At the beginning of his lecture Mr. Williams grumbled about the steel foundryman adding a quarter of an inch in thickness to the back of the flanges after he had received a pattern. It was rather difficult to understand that any foundryman, after a discussion with the people who were going to make a pattern, should require to alter it. Why should a foundryman, who has had such an opportunity of asking for the pattern to be made to suit his own requirements, go home and immediately alter that pattern?

Was Mr. Williams making the great mistake and fault often found with engineers who wanted to buy castings, of preferring to discuss design with anybody except the man who was going to do the job? Knowing Mr. Williams, the speaker did not think he was the man to do that, but he might have fallen into bad repute and carried on a discussion with a man who knocked at his door and said "Will you give me an order for some castings?" A good salesman probably, but not the man to say how patterns should be made. As foundrymen he (the speaker) thought they were aware that far too many engineers were only too happy to discuss production with the people who were not concerned directly with manufacture. Without fear of contradiction, he would say that if an engineer would be open when he was going to buy castings and lay his cards on the table, the foundryman would give him a better job than some of the jobs they had heard of that evening. They owed a great debt of gratitude to Mr. Williams for his courage in meeting the foundrymen and expressing his views as he had done.

MR. WILLIAMS said, with regard to the question of coring out the rims, the stresses on the rims were so high that they could not consider doing anything of the sort. They were for winding engines, and nobody could calculate what loads would be imposed upon them. The conditions of service were abnormally severe, and they could not weaken their ribs by putting cores on. Those castings were made by one of the biggest founders in the country. When they bought castings, they were not going to pay more for them than they were forced, though they did not seek the very cheapest. One of the troubles over the matter of cost, which Mr. Pollard had spoken about, was that people cut in on a price and then tried to take it out of the job. That was wrong. With regard to the adding of ¼ in., he suffered from no illusions about that. He got the people direct out of the foundry when he wanted to talk about patterns. He interviewed practical people, and made patterns to their requirements, and he had gone to their works and found them to have altered their minds. There should be no need for that if the foundryman knew his job.

Straight from the Shoulder

MR. F. WHITEHOUSE said he would like to suggest that perhaps Mr. Williams was hardly fair in criticising foundrymen as he was doing. It was probably quite true that many mistakes were made in the foundry, and that they were made in every foundry. But he was not prepared to admit that, considering the conditions in which the foundryman worked, he made an excess of mistakes. It seemed to him that in one breath Mr. Williams admitted that they could do the job, and then, in the next breath, said they could not do the job. He thought Mr. Williams was trying to suggest that they could do the job, but not at the price. It was quite true that they could not, either as foundrymen or anyone else, do a really sound job at less than a proper price for it. Probably every foundry had experienced jumping on the market, with a low price, to see if they could do it. Probably somebody above the men took the job and told them they had to get a move on and cut the price down so that it would be competitive. Then the casting was at fault. Might he suggest that Mr. Williams should be more considerate towards the foundryman, considering the difficulties in which he worked, and have some sort of regard to the price. Throughout the country there were firms capable of turning out good-class work, and he suggested these were the firms first in the bankruptcy court on account of engineers going to the cheapest market, sometimes getting away with it and, when they did not, grumbling.

MR. WILLIAMS said there was some degree of truth in Mr. Whitehouse's remarks about people jumping into the market and then trying to take it out of the job. They all knew cases of that kind, but he was going to submit, if it needed any submission on his part, that the castings themselves proved his contention, that that was a policy which did not pay. There was the cost of production, and then there was the bill he sent for the loss of machine time and cost of welding. It would be better to have him as a pleased customer and spend another £20 on that casting than to upset his shop programme and put him to all that trouble. So far as he understood Mr. Whitehouse properly, he gathered that Mr. Whitehouse thought he contradicted himself when he said "You can do the job, but you don't do the job." His (the speaker's) whole point was that foundrymen could do the class of work he required, but the trouble was they did not. He thought there was no doubt they could produce the very things he wanted. He thought he gave himself away when he declared that the foundry always claimed a very large share of his interest, and he did claim to understand foundrymen's difficulties and appreciated them, but there was a spirit abroad to-day which was not prepared to deal with difficulties. If people got a difficult job they wanted to push it on one side. The foundry was the very last place where that kind of spirit should be allowed to exist. Nothing he had heard and he did not think anything he might hear that evening would alter his whole view as to what foundrymen could do if they would try. It seemed to him that a firm's reputation and the quality of its castings should be of more importance than the mere saving of £5. He knew that cheaper firms did not look at it that way, but he was speaking of firms of repute who were known all over the world. He was not speaking of firms who were in a small way of business.

Lack of Co-operation Responsible

MR. J. ROXBURGH said he was afraid it was rather a difficult matter for a foundryman to contradict Mr. Williams in many of his remarks regarding the defects and the waste which occurred in a foundry, but, on the other hand, all foundries make defective castings and wasters, and so there must be some good reasons for their occurrence. Unfortunately, the foundryman seemed always to be in trouble, and, even when advancing an explanation, he always seemed to the engineer to be putting forward excuses. He felt very often, however, that these excuses were perfectly justified. In the first place, he quite agreed with Mr. Pollard that the human element played a big part in obtaining good, sound castings, and the individual skill of the moulder was always to be reckoned with. In addition to that, the raw material with which the foundryman was called upon to work, unfortunately varied a great deal, and he instanced for example sand and pig-iron. They had tried to standardise pig-iron, and most people to-day controlled their analyses. Analysis, in his opinion, however, was merely a guide. He thought that fracture was really more important. When dealing with a cylinder, it was easy to get the same percentages of carbon, silicon and other elements in two or three ways, by using different irons. If they were, for example, to start with an open-grained pig-iron and add their steel, etc., they could still get the desired analysis, but they would obtain an entirely different structure from that of the usual close-grained cylinder irons and scrap. It was only by a great deal of experience that one was able to get a close-grained iron suitable for such a casting. Mr. Williams had shown them a segmental casting and complained that flatness always occurred in such castings. He (the speaker) wondered whether it would be possible to cast such a casting as a unit with splitting cores or machine it into segments. That would definitely obviate any question of flatness, and very often they would find that it was much cheaper, too. They had a job in their own foundry very similar to that. It was cast as a cylinder and machined up into segments to form curved doors, and that was the only way to overcome the trouble of not getting a true curvature. With regard to the ¼ in. on the back of the flange of a casting which had been mentioned, there was another variable in regard to foundry practice, and that was the question of contraction. If they were to take a condenser 6 or 7 ft. long, cast on end, flanges top and bottom, with a head on the top flange, they would find that, when the head was cut off, the thickness of the top flange, in many instances, varied quite considerably with the same type of metal. They made a definite rule in their foundry that on the back of both flanges they must put ¼ in. to allow for contraction, and so ensure that the flange would be at least the thickness given on the drawing after machining. Some other problems which arose in the foundry were, in his opinion, wrapped up with design. Mr. Williams had criticised foundrymen. He (the speaker) thought the foundryman had a perfect right to criticise the engineer, and if more co-operation existed between the engineer and the foundryman, he thought better results would be obtained. Some of the designs which were sent out obviously denoted that there had been no co-operation at all. As soon as they got a thick and thin section together, there was a possibility of the sponginess to which Mr. Williams had made reference, which the founder endeavoured to overcome by the use of denseners. "Thick and thin

sections" was quite a problem, and presented great difficulties to the founder in getting a sound casting. He felt that, when dealing with a jobbing foundry, every casting was a problem in itself. In his opinion, every casting in most jobbing foundries had the consideration to which it was due. There were no really hard-and-fast rules about foundry work, and the manufacture of every casting must definitely be considered on its merits. Even after every precaution had been taken, as Mr. Williams admitted himself, it was only after the first casting had been made that some defect was revealed, and consequently alterations had to be made in subsequent practice. He thoroughly appreciated Mr. Williams' remarks, which were purposely provocative, and the foundryman, for his part, appreciated that he must do everything in his power to try to meet the requirements of the engineer.

Making Segmental Castings

MR. WILLIAMS admitted that the best of them felt like that, but he could only judge by hard facts and the castings he received. So far as the question of castings affected by design was concerned, here he was in a very difficult position because one part of him sympathised with the engineer and the other part of him sympathised with the foundryman. In this Jekyll and Hyde position the engineer refuted Mr. Roxburgh's statement and the foundryman admitted it. With regard to adding ¼ in., his contention was that if they knew it was right to have it, why did not they make a pattern for it in the first instance? He felt they were getting somewhere in that discussion, because Mr. Roxburgh had made some remarks with which he was in entire agreement out of his own experience. He had found that the most satisfactory way of casting segmental castings was to cast them in a ring, put cores in them, and if care was shown in the pouring temperature and rate of cooling some very good results were obtained. They did that with large cast-iron work, and it was the only way to get what was wanted. To deal with that they required some big tackle, which defeated some of the smaller foundries. But in the cases he had illustrated it was well within the capacity of the foundries to do them in rings. It was a question of knowing what was wanted, how to do it, and giving him a job which satisfied him. There was probably no form of work in which there were so many variables as there were in a foundry. He certainly knew of none. It seemed to him that it was of great importance to control those variables that were quite well known, and which, in 90 per cent. of the cases they knew how to prevent. There were variables which they could not control, such as metals and sand. Those things had to be taken more or less for granted, unless they were going to make each job a laboratory job, and then it was no longer a commercial proposition. He submitted that the variables which they knew of and were within their ability to control should receive a large share of their attention.

MR. F. WHITEHOUSE: When the engineer knows where he can get the good castings why does he not give the same firm a second order, instead of going elsewhere and being often disappointed?

MR. WILLIAMS: In the present case it was lack of capacity to deal with it.

MR. WHITEHOUSE: I think Mr. Williams was very fortunate in that case to have such an excuse.

MR. WILLIAMS said there was another and rather more serious aspect of the matter. He received some thousands of castings and they could not possibly buy them all from one foundry. When it came to dealing with the big engine castings, he had three engines going through the shops now, and there were over 200 tons of steel castings on each. No one foundry was capable of giving him those castings in time to enable him to deliver to his customers at the proper time. That made him give orders outside the scope of any financial considerations. They were not always able to place the orders where they liked.

Most Variables Controllable

MR. P. A. RUSSELL, B.Sc., said that Mr. Williams had disarmed criticism by stating that all the troubles enumerated were due to carelessness in not taking proper precautions, so that, if proper care was taken, good castings could be produced. He was not qualified to speak on the examples of steel castings shown, but with regard to the iron casting with the cores 1½ in. out of position, he was of the opinion that this showed a lack of correlation between the drawing office, patternshop and foundry.

If it had been stated on the drawing that these holes had to match others, then the patternshop should have ensured that the foundry took the necessary care. As it was, the prints were probably loose prints tacked on to the side of the pattern, which the moulder had worked loose and so displaced them. He believed that most founders who were members of the Institute took a pride in their castings, and he thought that Mr. Williams' address would probably have been more effective if delivered to those founders who were not members. He did not agree that, if they controlled every job scientifically, they made every job a laboratory job. He was sure many of the variables were within their control, in addition to what Mr. Williams had mentioned about the ordinary moulding.

"Core Stroking"

MR. WILLIAMS said he was receiving support from unexpected quarters. He would not have dared to say that foundrymen could go so far as to admit that they could control the variables. Mr. Russell thought they could. They ought to have had a few members of the pattern-makers' trade to hear that charge about the use of a few loose prints. The trouble was the natural propensity of the moulder to go about with a little bit of rubbing cloth in his pocket and stroke down every core that he got hold of. That was the trouble in this case. It was not that the prints were out of place on the pattern; it was due either to faulty finishing-off of the mould or rubbing down of the core before it was put into the print hole. Of that he was convinced. They had tried to forbid their old moulders from carrying those "weapons" about with them, but it was a difficult matter. They had had to take most severe action just recently. They did a lot of overseas work in cases where the freight charge was 2d. per lb., so that the weight of their iron castings became a matter of the most material importance. They helped in this matter by making the patterns thinner than the normal size. They made a pattern $\frac{1}{16}$ in. less and found the casting the size they wanted.

MR. H. BUNTING said Mr. Williams complained that foundrymen were not keeping pace with the times, and yet, he believed, at Markham's they were turning out machines that were far better than those of 25 years ago. They were having greater speeds, greater powers from the products of the foundry, and yet the foundrymen were told they were not making progress or keeping pace with the times. The engineer asked for a reduction in thickness with increased strength and less machining allowance; this request the foundryman has complied with. It was difficult to reconcile statements of that description. It would be very interesting if the engineer could listen to what the foundryman had to say about him. Great play had been made about the extra ¼ in. In the old days, when he first started in the foundry, it was a common saying, "Give them some weight and they will come again." Now, if they gave them some weight, they would not come again. How was it that the engineer so often had to come and have alterations made in the patterns after they had started to be moulded? Why did not they see to their job and say what they wanted? What the engineer called minor alterations often caused very much work in a foundry. He thought Mr. Williams gave himself away when he said that cost was a great factor. He admitted he got perfect castings and then he took his trade somewhere else. He ignored those first perfect castings, but he admitted they were a credit to the foundryman's work. Cost was one of the great factors they were up against; they had to meet competition. If due consideration was given—he was speaking of the industry as a whole—to those points, he thought the foundryman could meet all requirements of the engineering side.

MR. WILLIAMS denied accusing the foundry of not having made any progress at all. That was belied by the state of the foundries, but he did maintain that they were not making the progress at the same rate as other engineering trades were doing. He could give quite definite figures of the percentage improvement in production costs in any one of the other departments of the works. He could give them, too, for the foundry, all that was taken from the last five years, and he thought they would be surprised at the disparity. The foundry case was not on all fours with the other departments, but he did submit that this was a matter that called for very great attention. Mr. Bunting mentioned the matter of cost. What they had to do was to combine the two things satisfactorily—castings at a price at which people could afford to buy. The engineer was criticised for making minor alterations. He had a colleague present who received some slight criticism at his hands on a similar point, but he was going to defend that colleague now because it arose from the foundries' insatiable demand for work, even though the drawings be not finished.

Human Element in Jobbing Foundries

MR. ROXBURGH, referring to the cored holes, said that instead of the moulder having to resort to rubbing his cores would it not be advisable to make his print such that the core would drop in? In other words, the bottom of the coreprint would be the size of the core and taper allowed giving clearance. Mr. Williams was comparing the progress made in the foundry with the progress made in other branches of the engineering trade. In his opinion it was a very unfair criticism, for this reason. If they were to point to the machine shop, what did its improvement really amount to? Its development arose definitely from the tool steels invented and from the introduction of more rapid machinery, but when you consider the jobbing foundry, skill has to be used in the actual creation of articles by the human element, as there were only one or two instances where they could apply machinery to certain operations. He did not see what great amount of progress on certain jobs could be made in the jobbing foundry, as the actual skill of the craftsman was involved.

MR. WILLIAMS said, so far as the machine shop was concerned, they could very largely set the pace in these days, with high-speed steel, and he thought they had to devise means of forcing a similar conclusion in the foundry. He agreed that it was difficult. He himself had no very clear views as to how it was going to be achieved, but it was a problem they had to consider. So far as erectors and benchmen were concerned, the basis for comparison with them and moulders was not an unjust one. The statement he made about the improvement in their ability in the last five years held just as good for them as for the machinists.

MR. G. OFFILER said he could not fit the 1½-in. variation into the rubbing of the cores or in the loose prints. But if there were combinations of castings going to be fitted together, and that if one drawing for one part went down into the patternshop and a pattern and casting made, the cores might be out $\frac{1}{16}$ in. if he did

(*Concluded on page* 346.)

New Avery Testing Machine

PORTABLE AND POWER OPERATED

A new testing machine has been standardised by Messrs. W. & T. Avery, Limited, of Soho Foundry, Birmingham, for capacities of 5 tons and 10 tons. The machine is of the hydraulic type and very compact. The composite parts (the pumping unit, straining mechanism and load-indicating mechanism) are all housed in a small base box. The machine is light and portable, and may be used as a field machine if electric supply is available. The load is applied by means of hydraulic pressure, which is also used as a means for indicating the load. The control of the machine is positive and extremely simple, merely involving the operation of the handwheel of the control valve. The bottom crosshead A (Fig. 1) is secured to the main ram B, which operates in the cylinder C under pressure from the pump. The columns D support the top crosshead E, which carries the top tension holder F. The bottom tension holder G is carried upon an intermediate crosshead H, supported upon the short tension rods J, secured in the saddle casting K, which also carries the main cylinder C. The saddle casting is secured to the top of the basebox L.

All testing operations are carried out by an upward movement of the crosshead A, with its superstructure, relative to the stationary crosshead H. The pump, motor, suction tank and weighing gear are secured to a plate casting M; the base box L is merely a shell covering, reinforced at the top to carry the straining cylinder and superstructure. The base box is provided with large inspection holes in three of its four sides, so that any part of the mechanism is readily accessible. Although no special foundations are required, the machine should preferably be arranged upon a solid plinth at a height to suit the operator.

Pumping Unit

The pump is of the annular piston type. It is of positive action, and, as oil is used as the pressure medium, it is completely self-lubricating. There are no idle pockets; the path of the fluid through the pump is simple and uni-directional, and is filled and constantly swept by the current of fluid passing. The construction of the pump is of extreme simplicity. The delivery is uniform and pulseless, making the pump eminently suitable for testing-machine requirements. All parts are made to fine-limit gauges, ensuring low cost of reconditioning.

The pump is secured to the side of its suction tank and is driven through gearing by a standard motor running at 1,400 r.p.m. suitable for either alternating- or direct-current supply, but single-phase supply should not be used if another supply is available. The delivery of the pump is capable of moving the ram of the testing machine upwards at approximately $\frac{1}{2}$ in. per min. The ram returns by gravity. A spring-loaded valve is interposed in the pipe line and is set to relieve at a pressure a little above the working pressure, to ensure the machine is not overloaded.

Straining Mechanism and Testing Accommodation

The strain is applied to the specimen by means of a single-acting cylinder and ram, rigidly held in a saddle casting secured to the top of the base box. Both cylinder and ram are ground to very fine limits. Packing is not used, and a very small amount of oil is permitted to force its way up between the cylinder and the ram, thus providing forced lubrication. This oil is collected in a recess provided at the top of the straining cylinder and gravitates back to the suction tank. The recess is fitted with a wiper and cover to prevent the ingress of foreign matter.

The standard machine is designed to carry out tests in tension, compression and bending; but tests in shear and hardness can be carried out by means of additional tools.

Tension Test.—The machine is designed for testing specimens of both the screwed and headed type. The specimen is positioned in the top holder F and the bottom holder G. The strain is applied by the upward movement of the main ram and its superstructure, which moves the crosshead E (with its tension holder) away from the stationary crosshead H, carrying the bottom tension holder. Both tension holders are provided with spherical seatings to facilitate correct alignment. Fig. 1 illustrates a tension specimen in position in the holders. Each holder is provided with an outer cover or shell which is free to rotate, so that the holders may be opened for insertion or removal of specimens, or closed for testing by a twist of the cover. The illustration shows the upper holder open and the lower holder closed. Various adaptors are supplied with the standard machine.

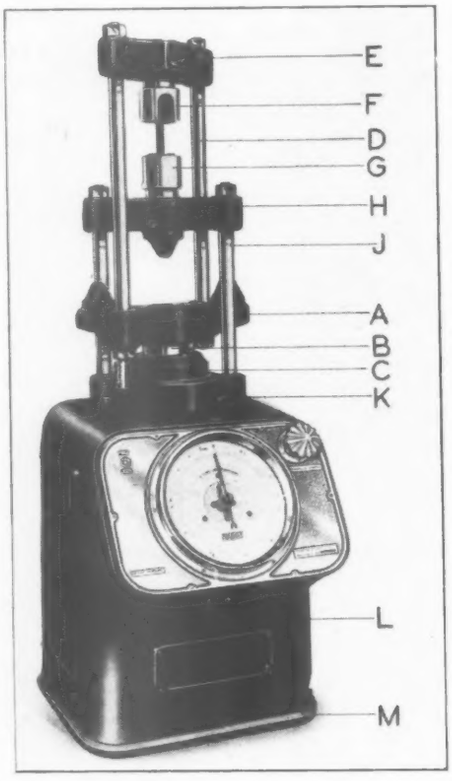


FIG. 1.—VIEW OF THE NEW AVERY UNIVERSAL TESTING MACHINE.

Compression Test.—The crosshead "A" fitted to the ram is provided at its centre with a platen upon which compression specimens are positioned. The underside of the intermediate crosshead carrying the bottom tension holder is also fitted with a platen against which a compression specimen is forced during a test. Both platens are marked to assist in the centralisation of the specimen. The upper compression platen is held in position by means of a spring-loaded ball which rests in an indent in the stem of the platen.

Transverse Test.—The lower crosshead "A" is provided with two small castings (known as dogs) to support the transverse specimen, and these can be located to give a span of 6 in. or 12 in. The presser foot is secured in the underside of the crosshead "H" by means of a spring-loaded ball.

Shear Test.—This is carried out with separate tools positioned between the crossheads used for the compression test. A double-shear test is applied to the specimen, which is threaded through bushes fitted to the tools. These bushes are exchangeable.

Hardness Test.—A fitment to carry a 10-mm. ball is provided for this test. It is secured to the underside of the intermediate crosshead. For this test the dial is plainly marked at 3,000 kilos. The specimen is positioned upon the bottom crosshead "A" and brought to contact with the ball, and further until the requisite load has been applied. The diameter of the resulting indentation is measured by a Vee scale or microscope, and referred to a table of hardness numerals. A microscope to magnify approximately 20 diameters can also be supplied to special order.

Load-Indicating Mechanism

The load applied to a specimen is in proportion to the hydraulic pressure in the straining cylinder. The straining cylinder is in connection with a small cylinder, the ram of which is made of fixed proportion to that of the ram of the straining cylinder, to ensure a known reduction in the pull to the lever system. The ram of the small proportional cylinder is arranged to operate in a phosphor-bronze liner in its cylinder, and in order to obviate frictional interference in the transmission of the load from this ram, the liner is steadily rotated during a test by worm gearing driven from a shaft geared with the motor driving the pump. The small proportional cylinder is secured to a casting which is also provided with bearings to support a weighing lever arranged immediately below the small ram. This lever reduces the load and transmits it to a main lever, to which the weighing resistant is attached. The main lever also translates the pull into movement of the spindle which carries the load-indicating pointer, in accordance with weighing-machine practice.

All loads are indicated upon a dial, marked in the form most acceptable to users of testing machines and arranged on the inclined panel of the base box. A second pointer carried from the centre of the glass is provided to indicate the maximum load applied during a test. This pointer is carried round the dial by the live-load indicating pointer, and remains at the highest position reached until reset by hand. The accuracy of the indicated load is plus or minus 1 per cent. for loads in excess of 50 per cent. of the chart capacity.

Import Duties

SILICON PUT ON FREE LIST

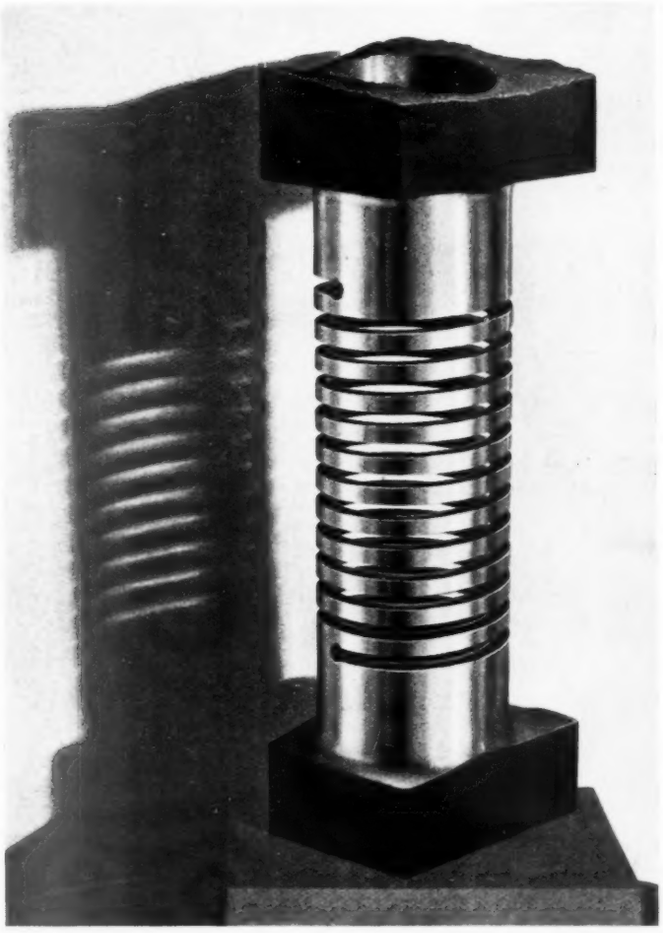
The Treasury, on the recommendation of the Import Duties Advisory Committee, has made an Import Duties (Exemptions) Order adding to the free list, as from November 23, silicon and alloys thereof containing not less than 95 per cent. of silicon.

Commercial silicon, it is stated, is used in the manufacture of various alloys of aluminium, copper and bronze, while alloys containing a very high percentage of silicon are used in the manufacture of certain steels. Both classes of material are made in the electric furnace and production is confined to countries where hydro-electric power is cheap. There seems to be little likelihood of production on a commercial scale in this country in the near future. The Committee state that the duty payable on the imported material represents an appreciable item in the cost of production of the special alloys made therefrom, and that its removal is desirable so that British manufacturers may be at no disadvantage with their foreign competitors, particularly in the export markets.

THE WIGSTON FOUNDRY (1934), LIMITED, is being wound up voluntarily. Mr. S. Fred Aspell, of Messrs. Aspell, Dunn & Company, Eagle House, Friar Lane, Leicester, is the liquidator.

Not a Shadow of Doubt—

Regarding the
MERITS of "NEW PROCESS" IRON



Users of "New Process" Iron have proved for themselves that the claims made are in no way exaggerated.

The illustration provides an excellent example of the close uniform grain, free from porosity and segregation, and the high physical properties which make such machining possible.

*A Standard Pig of "**New Process**" Iron machined to the shape of a 3-in. diameter spiral spring.*

ARMSTRONG CLOSE WORKS — SIR W. G. ARMSTRONG WHITWORTH & Co. (IRONFOUNDERS) LIMITED — WHITWORTH GATESHEAD ON TYNE

Telephone: Gateshead 71181. *Telegraph: "Closework, Gateshead-on-Tyne."*

General Refractories' Coming-of-Age Celebrations

MAGNESITE BRICK WORKS INAUGURATED

A very happy event took place on November 10, 1934, when General Refractories, Limited, the well-known manufacturers of refractories, whose head office is at Sheffield, celebrated three notable achievements, viz.:—(1) The twenty-first birthday of the company; (2) the installation of a new brickmaking plant—the most modern of its type in the world—at their Worksop works: and (3) record sales in the month of October, 1934.

A New Magnesite Brick Factory Opened

At the Worksop works on the Saturday, the Mayor and Mayoress of Worksop (Alderman C. A. Longbottom, J.P., and Mrs. Longbottom) were received by Mr. Frank S. Russell, F.G.S. (Chairman and Managing Director), and Mrs. Russell, and other representatives of the firm.

The march of events began soon after 11 a.m., when the Mayoress cut a white ribbon with a new pair of scissors handed, and afterwards presented as a souvenir of the occasion, to her by Mr. Gregory, the works manager.

The Mayor and Mayoress then walked forward to near the Hardinge mill, where the Mayor pressed the button which set the new plant in motion, including the Hardinge mill, the lightning crusher, the elevators, screens, pan mill, press, etc.

The oldest employee, Mr. Joe Gardener, then emptied a bag of magnesite on the floor, which the Mayor proceeded to shovel into the grating, from which the material, after passing to the measuring tub, from the hoppers, was pushed forward, assisted by the Mayor and Mayoress, to the pan mill, from whence it was emptied into the skip hoist and then went on to the press hopper. The Mayor pulled a lever, the press commenced to work, and four bricks were delivered.

The Mayoress placed one of the bricks on to a pallet, whilst others were placed by Mrs. Russell, Mrs. Kirkby (wife of Mr. R. A. Kirkby, assistant general manager of General Refractories, Limited), and Mrs. Whiteley (the wife of the member of the staff with the longest service).

The Mayor, in declaring the plant ready for use, said he dedicated it to the service of those who had harnessed heat to be the servant of mankind, and sincerely hoped that General Refractories, Limited, would have the success they deserved in this wonderful enterprise that they had brought to the Borough of Worksop.

Replying on behalf of the company, Mr. Russell said he thanked both the Mayor and the Mayoress for their presence, and asked each of the ladies who had made the first four bricks to accept a small souvenir. He had particular pleasure in offering the gift to Mrs. Whiteley, because Mr. Whiteley was the first assistant that they could afford to engage away back in 1913. He added that each of these bricks would be inscribed with the initials of each of the ladies, then burnt as hard as stone, and treasured in the company's archives.

The gifts presented by Mr. Russell, on behalf of the company, took the form of miniature bouquets fashioned in china.

The party, conducted by Mr. John Gregory (manager), then proceeded to inspect the works, where everything was working at full pressure, including the hydraulic press. An inspection was also made of the kilns, where setting, firing and drawing were in operation.

After the tour of the works the party proceeded in motor buses to Central Hall, Worksop, where they were entertained to luncheon by the company.

Inaugural Luncheon

Following the luncheon, Mr. R. A. Kirby (director) proposed the toast of "The Borough of Worksop," which was responded to by Alderman C. A. Longbottom, J.P., who also proposed the toast of "General Refractories, Limited," to which Mr. Frank S. Russell, F.G.S., responded. Other speakers at the luncheon included Alderman Henry Hartland, J.P. (chairman of the Worksop Borough Electricity Committee), Mr. J. H. Goddard (secretary of the Worksop Chamber of Trade), Mr. W. J. Ress, M.Sc., F.I.C. (head of the Refractories Department of Sheffield University), and Alderman T. Fullard (deputy Mayor).

Celebration Banquet

At 6.30 p.m. on the same day a celebration banquet was held at the Royal Victoria Hotel, Sheffield, where Mr. Russell was in the chair. A number of congratulatory telegrams and letters, including one from the Editor of THE FOUNDRY TRADE JOURNAL, were then read. The speakers at the banquet included Mr. E. P. Page, Mr. Frank S. Russell, Mr. W. A. Whiteley, who presented Mr. and Mrs. Russell, on behalf of the staff, with an old Sheffield plate tray, made in Sheffield in 1822, and two pairs of old Sheffield plate candlesticks, made in 1828. Following upon this happy break in the proceedings, Mr. Whiteley proposed the toast of "Our Guests," which was responded to by Mr. W. J. Rees and Mr. C. E. Hibberd. The toast of "The Directors" was proposed by Mr. F. M. Fisher (Coolee, Limited), to which responses were made by Mr. Kirkby and Mr. George Senior. The remainder of the speakers were Mr. Widlake, Mr. W. A. Cutts (secretary), and Mr. A. C. Turner (manager of the London office).

Selections by artistes, and an exhibition of films taken by Mr. Russell on his foreign tours, also contributed to the success of the evening.

Finally, Mr. Turner presented Mr. Russell with the signatures of the staff, which had been written on a menu card.

Foundry Methods from an Engineer's Point of View

(*Concluded from page* 343.)

not know it was going to be fitted in combination with another casting. He thought there was a possibility of variation there, because it had not been notified in the first drawing that it had to be matched up with another casting. Those errors occurred very often in the drawing office, and were handed down to the pattern-shop and through to the foundry. Was it the practice to have these details embodied on the drawings that went down? Were the core holes definitely stated to be matched up with another part of the machine?

MR. WILLIAMS said he thought there was a lot in those remarks. The trouble in the example of the core-hole he quoted was the great length of the hole. There should be no difficulty if they got castings only 3, 4, 5 or 6 in. deep, but when they had a bad casting, 2 ft. 6 in. deep, they would appreciate that, with a little rubbing at either end, it was not difficult to get the results he mentioned.

They did, in the main, mark their drawings as to what the holes were for and what should go through them, and, in the case of foundation bolt holes, they often went a step further and, knowing the delinquencies on the part of the foundry engineering staff, tried to safeguard against them by having adequate clearances round bolts. It was a question of the length of the hole that was the trouble. He had had that trouble quite recently.

MR. HALL said he had been in Mr. Williams' foundry and fitting shop that afternoon, and had seen bearings having to be machined to hold the babbit for them to be cast on.

MR. WILLIAMS said it was the responsibility of the foundry to babbit the bearings for him, and they had been trying to do those things in a cheap way without sacrificing their quality. They had a standard below which they would not go. But, like everybody else, they must make experiments to reduce costs. They decided they would have a shot at casting those bearings in that way and try to babbit them. He had had to scrap half-a-dozen bearings because the babbiting had not been up to the standard he had required and below which he was not prepared to go. To achieve the standard he wanted it was quite clear they had to tin the bearings. If Mr. Hall would tell him how to tin cast iron without first machining it, he would be indebted to him, because it would give him a chance of cheapening the cost of production.

MR. HALL said he had cast hundreds of bearings for the B.T.H. Company, and they had never cast one without the babbit. He was talking about one 3 ft. in length. They always cast with the recesses to hold the babbit.

MR. WILLIAMS said he had decided to have those recesses increased in number. It was far cheaper to take them to a machine and machine them out. If he cast them again, he still had to machine them, because he must tin them.

MR. PEACE proposed a vote of thanks to Mr. Williams, and said he had delivered a very provocative address, and had come to them not as a lamb to the slaughter, but rather as a Daniel in the lions' den.

MR. C. W. BIGG, in seconding the vote of thanks, said he thought that in the jobbing foundry they had to be prepared to leave less to the men. He was not saying that the men were less skilful than they were, but the management had to accept more responsibility. They had to know their costs more correctly. That would prevent many of the criticisms they had heard that night in regard to people slashing prices. Mr. Williams knew sufficient about the foundry job to be sympathetic, and he had very much enjoyed his Paper.

MR. WILLIAMS, replying to the vote of thanks, which was heartily passed, said he was pleased to have had the opportunity, through the kindness of his directors, of showing them round the works and having that little talk. He did appreciate foundrymen's problems, but that did not alter the fact that he still thought many of them were capable of solution. He endorsed Mr. Bigg's remarks that they must leave less and less to the men. They must give clear instructions to the men.

MR. PEACE expressed the thanks of the East Midlands Branch to the Sheffield Branch for their invitation that day, and for the excellent arrangements they had made. They hoped to invite the Sheffield Branch next year.

Notes From the Branches

Scottish Branch.—The annual dinner of the Branch will be held in the Grosvenor Restaurant, Gordon Street, Glasgow, on Saturday, December 8. It is expected that the President of the Institute, Mr. Roy Stubbs, and the secretary, Mr. Makemson, will be present. Bailie Cochrane, in the unavoidable absence of the Lord Provost, will reply for the City and Corporation of Glasgow, which will be proposed by Mr. William Wallace, managing director of Messrs. Brown Bros. & Company, Limited, Edinburgh. The honorary secretary, Mr. Bell, will be glad to receive applications for tickets from any members or visitors who intend to be present as soon as possible.

THERE IS SOME SPECULATION at Jarrow respecting the dismantling of Messrs. Palmer's blast furnaces and steelworks. The dismantling and sale of plant and material are being done by Messrs. Thos. W. Ward & Company, Limited, of Sheffield, who purchased the works, but it is understood that operations have been suspended. No official information can be obtained as to the reason for the suspension or whether it is only of a temporary nature.

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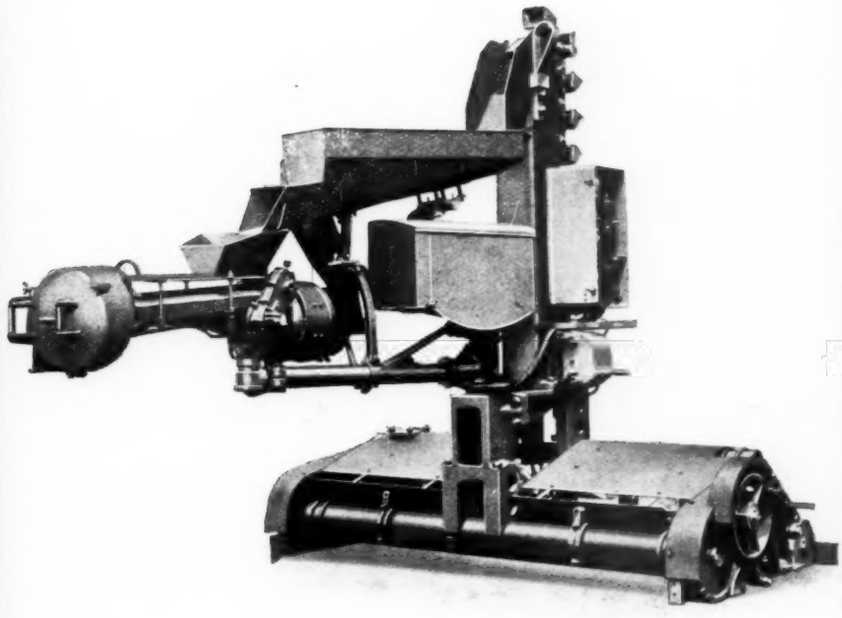

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This Week's News in Brief

Trade Talk

THE GLASGOW CORPORATION transport department are in the market for 100 new buses, the contract price of which will approximate £200,000.

MR. ALEXANDER RAMSEY, O.B.E., who has recently been appointed chairman of the National Engineering Employers' Federation of Great Britain, in succession to Sir Alan Smith, K.C., served his apprenticeship in the works of the Stirling Boiler Company, Limited, Motherwell.

MESSRS. ALBION MOTORS, LIMITED, Scotstoun, Glasgow, have obtained an order for 75 oil-engined bus chassis from the Bombay Electric Supply & Tramways Company, Limited. This is the second repeat order which the Albion Company have received from the same source.

MESSRS. HARLAND & WOLFF, LIMITED, have secured contracts for the building of five motorships, three for the Blue Star Line for their New Zealand service, each of 11,000 tons and two of 13,000 tons each, for the Union Castle Line's intermediate South African service.

MESSRS. BARCLAY, CURLE & COMPANY, LIMITED, have booked an order for a passenger- and troop-carrying liner from the British Steam Navigation Company. The vessel will be of 11,000 tons, fitted with Barclay Curle-Doxford Diesel engines, to be built at the firm's Scotstoun works.

MR. J. S. MURDOCH, chief engineer to Shotts Iron Company, Limited, who has taken charge of the foundry for some years, has now been relieved of that responsibility in order that he may give full attention to the increasing engineering work. Mr. Alexander Walker, cost clerk, has been appointed foundry manager.

THE EMPLOYEES of the firm of Sharp & Company, Limited, Lennox Foundry, Alexandria, have donated the sum of £13 13s. to charitable institutions. The employees of Messrs. Jones & Campbell, Limited, Torwood Foundry, Larbert, have subscribed £5 15s. to the Christmas treat to unemployed children scheme. The Shotts Foundry Silver Band have sent to the Lord Provost of Edinburgh Fund for the Gresford pit disaster the sum of £42.

A LOW-TEMPERATURE CARBONISATION PLANT is to be erected in the north-west area of Glasgow. A site for this work had been bought, and is now being surveyed to enable the plans to be prepared for the new plant. The capital for this scheme is assured, and the promoters are confident of success. It is believed that Glasgow offers a big market for the products resulting from the low-temperature carbonisation processes, while the proximity of the city to the Lanarkshire and Stirlingshire coalfields ensures an abundant supply of coal.

MESSRS. WILLIAM BEARDMORE & COMPANY, LIMITED, Dalmuir, have recently received orders for a number of Diesel engines. An Aberdeen firm of haulage contractors have given a repeat order for an engine built at Dalmuir about 12 months ago, and which in the interim has covered 80,000 miles without requiring repairs. This engine, whilst not of the firm's latest design, is an improved form of the engine which obtained the premier award in the recent competition in Russia. Orders have also been obtained for three sets of marine Diesel engines. One of the Dalmuir latest types is now being tried in an L.M.S. restaurant train.

MESSRS. THOS. W. WARD, LIMITED, of Sheffield, whose new capital issue of 350,000 first cumulative preference shares of £1 was heavily over-subscribed last Tuesday, have acquired for dismantling purposes the Bennerley Blast Furnaces, near Ilkeston. The furnaces were originally built by Mr. E. P. Davis about 1870, and the "Awsworth" brand of Derbyshire foundry pig-iron is well known. For the last twenty years only two of the three original furnaces have been in blast, and the furnaces have not produced pig-iron since March, 1931. The Erewash blast furnaces of the same company were dismantled five years ago by this concern.

A NEW ORDER issued by the Free State Government imposes a Customs duty of 25 per cent. *ad valorem* on imported cast-iron connections which are suitable for use in relation to underground gas pipes, water pipes, or sewage pipes, and which are at every opening of an internal diameter of not less than 3 in. and not more than 15 in. Cast-iron connections which are at two or more openings constructed for joining by means of bolts or studs will not be subject to this duty. In connection with the introduction of the order, it is announced that the necessary plant for the manufacture of cast-iron connections, now subjected to duty, is available in some of the existing Free State foundries, so that there will be no difficulty in obtaining supplies from home sources.

TWO DISPUTES are in progress at present in the heating engineering trade in Dublin. Members of the engineering and foundry union have been withdrawn from Messrs. Musgraves, because of the alleged refusal of the firm to sign an agreement covering working conditions, and in the second case the same union has called out its members from Messrs. McCanns. This firm, it is stated, holds the view that there is an inter-union dispute between the body and the engineering industrial union, but the Dublin Trades Union Council argues that both unions are agreed that the question at issue is imported labour, and have agreed to co-operate in resisting the employment of outsiders while their members are unemployed. No progress at a settlement has been made in either case.

MESSRS. PHILIP PIERCE & COMPANY, LIMITED, the well-known Irish manufacturers of farm implements and agricultural machinery, announce that they have under consideration the establishment of a factory in Great Britain, with a view to recapturing the trade lost in that part of the country in recent years. Although trade with Britain diminished, the effect of the tariffs levied on imported agricultural implements and kindred products had a very beneficial effect on the firm's trade throughout the Free State, their output expanding to the extent of over 40 per cent. A representative of the firm states that they feel it is an injustice to pay import duties on materials while English firms which elect to open factories in the Free State are permitted to bring free the plant they desire for their new businesses. Messrs. Pierce are hopeful of securing a serious share of the English market, once they commence operations.

Contracts Open

Manchester, December 5.—30-ton weighbridge, for the Highways Committee. The Highways Department (District Surveyors' Office), Town Hall, Manchester, 2. (Fee £1 1s., returnable.)

Lourenco Marques, December 21.—Ten electrically-operated portal cranes, 3 metric tons capacity, for the Ports and Railways Directorate at Lourenco Marques. The Department of Overseas Trade. (Reference A.Y. 12,789.)

Horsforth, December 11.—12-in. cast-iron pipes and specials, valves, penstocks, manhole covers, valve shaft ironwork, etc., for the Urban District Council. Mr. J. E. Aldersley, waterworks engineer, Council Offices, Horsforth. (Fee £2, returnable.)

Farnham, December 8.—The Council invite tenders for short lengths of 6-in., 5-in., 4-in. and 3-in. dia. spun-iron mains, with special cast-iron pipes, valves, etc. Messrs. J. Taylor & Sons, Caxton House, Westminster, S.W.1. (Fee £5, returnable.)

Southampton.—Pumping unit, consisting of centrifugal borehole and surface pumps, Diesel engine, and certain auxiliary plant, for the Town Council. Mr. J. Hawkesley, waterworks engineer, Civic Centre, Southampton. (Fee £3 3s., returnable.)

Sturminster, December 12.—Providing and laying about 18 miles of 7-in. to 2-in. steel and cast-iron mains, and other works, for the Sturminster Rural District Council. Mr. A. J. Allen, Half Moon Street, Sherborne, Dorset. (Fee £2 2s., returnable.)

Company Reports

Hepworth & Grandage, Limited.—Payment of 10 per cent. on old shares, less tax.

John I. Thornycroft & Company, Limited.—Loss for year, £51,110, exclusive of debenture interest and directors' fees; transferred from reserve, £66,000; carried forward, £2,574.

John Williams & Sons (Cardiff), Limited.—Profit, £9,107; brought in, £6,527; preference dividend, £1,500; dividend on the ordinary shares of 5 per cent. (free of tax), £3,800; bonus to staff, £750; depreciation of investment, £1,145; new plant for alloy cast iron, etc., £1,000; to general reserve, £2,000; carried forward, £5,440.

Personal

MR. MAURICE E. DENNY, chairman of Messrs. William Denny & Bros., Limited, Dumbarton, has accepted nomination as President-Elect of the Institute of Marine Engineers.

MR. ANDREW GARDNER, who was for a long time associated with the Glasgow works of Messrs. Harland & Wolff, is leaving Britain in the near future to take up a position with Messrs. Metters, Limited, of Melbourne, Australia.

COLONEL ALAN STEIN, managing director of Messrs. John G. Stein & Company, Limited, firebrick makers, of Bonnybridge, was married at St. Michael's Church, Linlithgow, on November 19, to Miss Dorothea Christian Cadell, daughter of the late Mr. H. M. Cadell, LL.D., D.L., the famous geologist.

MR. J. S. RAMSDEN and MR. F. SAMUELSON have been appointed directors of the British Thomson-Houston Company, Limited. Mr. Ramsden, who is industrial sales manager, joined the B.T.-H. Company in February, 1910, having previously served his apprenticeship with Messrs. Dobson & Barlow, Bolton, and having worked for three years with the British Westinghouse Company at Trafford Park and for a shorter period in the electrical department of Messrs. Vickers, Limited. Mr. F. Samuelson has been with the B.T.-H. Company for over 37 years, having joined in May, 1897, and has been in charge of the company's turbine design and manufacture ever since 1903. He is a member of the Council of the Institution of Mechanical Engineers and chairman of its Midland Section.

Wills

AIRD, SIR JOHN, Bt., of London, engineer	£466,501
COLE, ALBERT, of Stamford, Lincs, retired iron dealer	£3,153

Obituary

MR. FRANCIS MACELHILL, of Dalmuir, has died as the result of injuries received from an apparently simple accident. Whilst at work in the foundry of the Singer Manufacturing Company, Limited, Clydebank, he fell from the fifth rung of a 10-ft. ladder, and died shortly after removal to the infirmary in Glasgow.

MANY SCOTTISH FOUNDRYMEN will learn with regret of the death of Mr. Henry Rule, which occurred at his residence in James Street, Falkirk. The deceased gentleman was for over 40 years in the employ of the Falkirk Iron Company, Limited, as a patternmaker, in which firm his father also served for over 60 years.

Forthcoming Events

Institute of British Foundrymen

DECEMBER 1.

Lancashire Branch:—"Foundry Costing," Paper by J. Roxburgh, at the Engineers' Club, Albert Square, Manchester, at 4 p.m.

DECEMBER 5.

London Branch:—Joint meeting with the Institute of Metals. "Manganese Bronze," Paper by Wesley Lambert, C.B.E., at the Charing Cross Hotel (First Floor), London, W.C.2, at 8 p.m.

DECEMBER 8.

East Midlands Branch:—"Suggested Method of Establishing Melting Costs in a Grey-Iron Foundry." Results of investigations by Costing Sub-Committee, presented by C. W. Bigg at the Loughborough College, Loughborough, at 6 p.m.

Scottish Branch:—(1) "The Work of the Technical Committee," Paper by J. W. Donaldson, D.Sc., F.I.C. (2) Annual dinner (at Glasgow).

Wales and Monmouth Branch:—Report of the Sub-Committee on Cast Iron of the Technical Committee, presented by B. Hird, at University College, Newport Road, Cardiff, at 6.30 p.m.

West Riding of Yorkshire Branch:—"High-Duty Cast Irons in the Foundry," Paper by C. Hall, at the Technical College, Bradford, at 6.30 p.m.

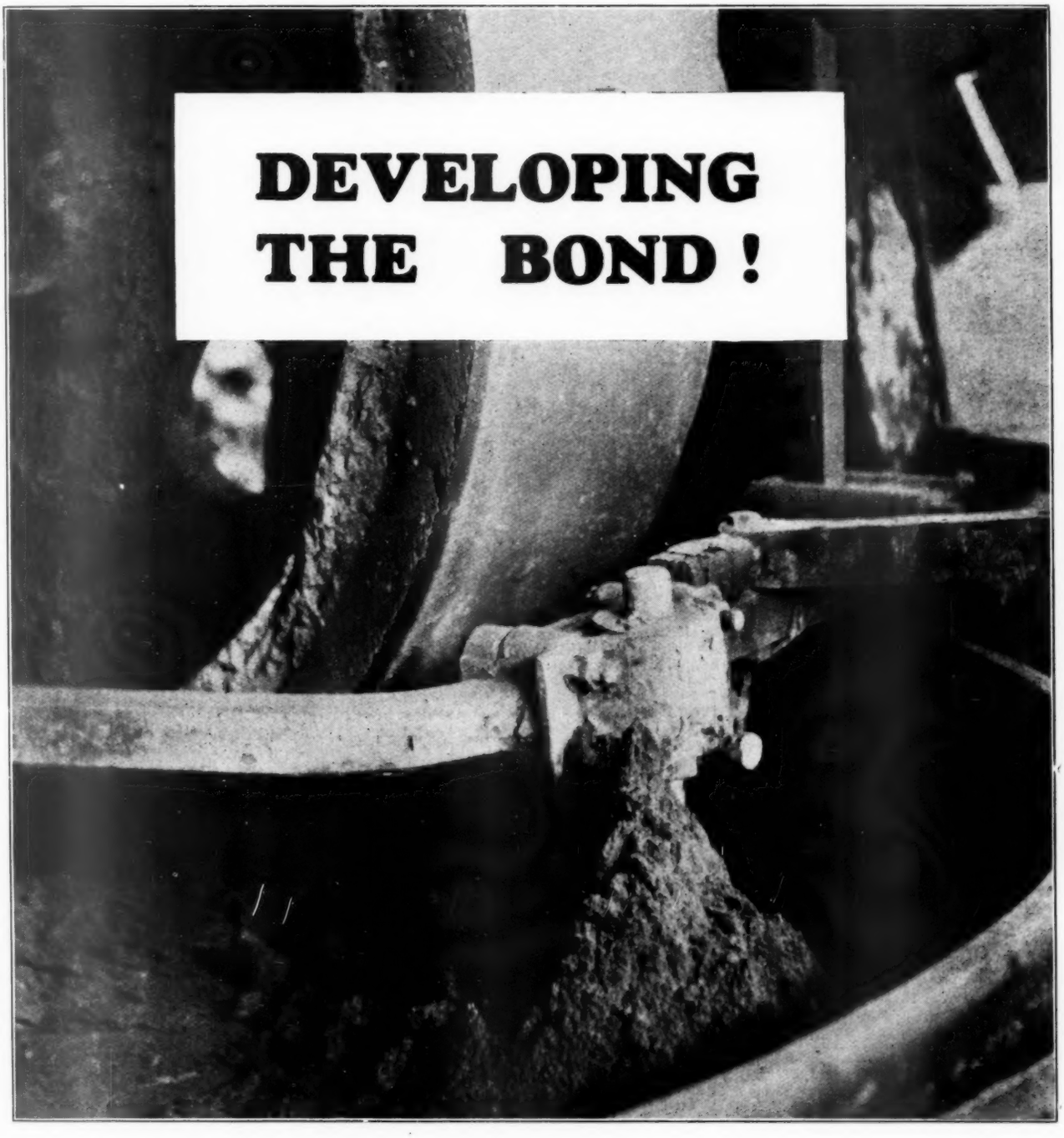
DECEMBER 11.

Burnley Section:—"Points for Practical Foundrymen—Contraction, Shrinkage, Chill and Camber," Paper by A. Jackson, at the Municipal College, Ormerod Road, Burnley, at 7.15 p.m.

Preston Section:—"Foundry Troubles," Paper by C. C. Hodgson, at the Technical College, Corporation Street, Preston, at 7.30 p.m.

DECEMBER 12.

Birmingham, Coventry and West Midlands Branch:—"Cupola Practice with a View to Closer Carbon Control," Paper by W. H. Bamford at the James Watt Memorial Institute, York House, Great Charles Street, Birmingham, at 7.30 p.m.



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Raw Material Markets

The outlook in the iron and steel trades for the coming winter gives ground for optimism. Stocks of pig-iron are gradually being decreased, and additional blast furnaces are undergoing repairs and renovations as a preliminary to relighting. The home demand for steel products is very heavy, and there is every indication of further progress being made in the export markets.

Pig-Iron

MIDDLESBROUGH.—The maintenance of the heavy home demand for Cleveland foundry iron has entailed the steady erosion of stocks at the makers' works. The producers have little surplus iron available for foreign trading, and have therefore increased their export quotations. In some quarters there appear to be apprehensions of an advance in home prices, but there is no hint of a change from official sources, and the fixed quotations for No. 3 Cleveland G.M.B. remain as follow:—67s. 6d. per ton delivered Middlesbrough, 69s. 6d. delivered North-East Coast, 67s. 3d. delivered Falkirk, and 70s. 3d. delivered Glasgow. Half-a-crown per ton more than the foregoing prices is charged for No. 1 foundry iron and 1s. per ton less for No. 4 foundry and No. 4 forge iron.

The demand for East Coast hematite is heavy, and still increasing. Consumers are showing more inclination to purchase their forward requirements. Export trading has been distinctly more active lately. There are no fixed quotations for this foreign trade, but 62s. 6d. per ton is now about the minimum, whereas the lowest home quotation for No. 1 East Coast hematite is 69s. per ton delivered Middlesbrough. To other areas the delivered prices are:—North-East Coast, 71s. per ton; Scotland, 75s.; Lancashire, 76s.; Yorkshire, 75s. to 78s.; Birmingham, 79s. per ton.

LANCASHIRE.—Although new business in pig-iron in this market is limited, deliveries to consumers against current contracts are maintained at a satisfactory level. Values are well held, with Staffordshire, Derbyshire and Lancashire brands of No. 3 iron all quoted for delivery to Lancashire users on the basis of 74s. per ton, Northamptonshire at 72s. 6d., Scottish foundry at about 82s. 6d., East Coast hematite at from 75s. to 76s., according to grade, and West Coast at around 78s. 6d.

MIDLANDS.—There is a strong demand for foundry iron, particularly from the light-castings trade, but supplies are ample to meet current needs. The present controlled prices applying to Birmingham and Black Country stations, carriage paid and subject to rebate to large consumers, are 67s. 6d. for Northants No. 3 and 71s. for Derbyshire, Lincolnshire and North Staffordshire No. 3. A fair trade is still being done in foundry pig-iron for general engineering purposes. Here, prices are not controlled and the various qualities which are used for different types of work are as follow:—Medium-phosphorus, between 72s. 6d. and 80s.; Scottish and other low-phosphorus irons, from 85s. to 87s. 6d., and special refined pig-iron from £5 7s. 6d. to £6 10s., delivered South Staffs stations. With regard to hematite, there is no new buying movement, and it is thought generally that this will not take place until the middle of next month, or possibly January. Most consumers are already covered.

SCOTLAND.—There is still room for improvement in the demand for Scottish foundry iron, the price of which remains at 70s. f.o.t. furnaces for No. 3, with 2s. 6d. per ton extra for No. 1. English remains in good demand. Cleveland No. 3 is unchanged in price at 67s. 3d. f.o.t. Falkirk and 70s. 3d. f.o.t. Glasgow.

Coke

Prices of foundry coke are firmly maintained. As stated before, the makers are well booked over the winter months. Current quotations for delivery in the Birmingham area are as follow:—Best Durham coke, 36s. to 40s.; Welsh, 35s. to 45s.; Scottish coke, 40s. to 41s. per ton, delivered Midland points.

Steel

Although the steel markets are approaching a time of the year when the volume of business usually declines, the demand at the moment shows little signs of shrinking. There has been a fair amount of forward contracting lately, in addition to a good flow of general buying, and confidence is felt that the industry will enter the New Year with a satisfactory reserve of orders in hand. There has been some decrease in the demand for semi-finished steel, largely due to consumers having covered their requirements for some time ahead. The works producing this class of material are well employed, and most of them are assured of good working conditions until the end of the year. Although there has been some buying of Continental steel, competition from this quarter has not been serious and most of the business coming on the market has been taken by home producers. Steady conditions rule in the finished-steel market. The constructional trades are providing a good outlet for steel, and the recent shipbuilding orders should help the industry to maintain the present rate of operations for some time. Inquiry on export account has expanded of late and a fair proportion has resulted in business.

Scrap

In the Cleveland district prices of ordinary heavy scrap iron and machinery metal are quoted at 51s. 6d. and at 53s. 6d. respectively, but, in view of the fair demand, increased quotations would not be unexpected. The demand for cast-iron scrap in the Midlands remains very stable, and prices are unchanged at 55s. for heavy machinery, 50s. for good heavy, and 47s. 6d. for light cast iron. In South Wales there is a moderate demand for heavy cast iron in large pieces and furnace sizes, which is steady at 47s. 6d. to 50s. per ton, but there is little activity in light cast-iron scrap at about 40s. to 42s. 6d. per ton. The scrap-iron market in Scotland is rather firmer, machinery cast-iron scrap being quoted at 56s. 3d., ordinary cast iron at 52s. 6d. and light cast iron at 45s. per ton, delivered.

Metals

Copper.—The consumptive demand for copper, so far as this country is concerned, remains fairly stable. The London market has displayed an irregular tendency, however, being largely influenced by rumours regarding the New York negotiations for an international producers' agreement on restriction of output. The position in regard to this question is no clearer now than it was a month ago. In view of the uncertainty of the outlook, buyers have generally kept to a policy of providing only for their immediate requirements.

Daily market prices:—

Cash.—Thursday, £26 13s. 9d. to £26 15s.; Friday, £27 to £27 1s. 3d.; Monday, £27 2s. 6d. to £27 3s. 9d.; Tuesday, £27 10s. to £27 12s. 6d.; Wednesday, £27 10s. to £27 11s. 3d.

Three Months.—Thursday, £27 1s. 3d. to £27 2s. 6d.; Friday, £27 6s. 3d. to £27 7s. 6d.; Monday, £27 10s. to £27 11s. 3d.; Tuesday, £27 17s. 6d. to £27 18s. 9d.; Wednesday, £27 16s. 3d. to £27 17s. 6d.

Tin.—At the meeting of the International Tin Committee in Paris last Thursday, it was decided to recommend to the Governments subscribing to the regulation scheme that the proportion of standard tonnages to be exported during the next quarter remain at 40 per cent. An interesting feature of the meeting was the attendance of Mr. John Hughes, of the United States Steel Corporation, representing American interests on the "advisory consumer panel." The British delegate has yet to be appointed.

There has been little change in market conditions, prices being rather firmer. Messrs. Rudolf Wolff, in their weekly report, say that "trade demand in this country is well maintained, but quiet conditions have prevailed on the Continent. In the United States of America consumers have shown a little more interest, and in consequence a rather more active market has at times been reported, but improvement in this direction is still meagre."

Price fluctuations:—

Cash.—Thursday, £228 2s. 6d. to £228 5s.; Friday, £228 5s. to £228 7s. 6d.; Monday, £228 12s. 6d. to £228 15s.; Tuesday, £228 15s. to £228 17s. 6d.; Wednesday, £229 15s. to £229 17s. 6d.

Three Months. — Thursday, £228 10s. to £228 12s. 6d.; Friday, £228 10s. to £228 12s. 6d.; Monday, £228 17s. 6d. to £229; Tuesday, £229 to £229 2s. 6d.; Wednesday, £229 15s. to £230.

Spelter.—The low level to which the price of this metal has fallen has attracted a fair amount of buying by consumers. The market is still being over-weighted with heavy supplies of foreign zinc, however, and the uncertain fate of the Cartel is another "bear" factor.

Day-to-day quotations:—

Ordinary.—Thursday, £11 16s. 3d.; Friday, £11 13s. 9d.; Monday, £11 16s. 3d.; Tuesday, £11 17s. 6d.; Wednesday, £11 18s. 9d.

Lead.—The high price obtainable for silver (which is mined in conjunction with lead) continues to have a depressing effect upon this market, and values remain low, in spite of the steady demand from home users.

Price fluctuations have been as follow:—

Soft Foreign (Prompt).—Thursday, £10 10s.; Friday, £10 11s. 3d.; Monday, £10 11s. 3d.; Tuesday, £10 13s. 9d.; Wednesday, £10 15s.

Catalogues Received

Electrical Supplies. The Donovan Electrical Company, Limited, of 46, Great Charles Street, Birmingham, 3, has issued a new and very comprehensive catalogue, running to 110 pages, which very effectually covers the field of small electrical supplies.

Structural Steelwork. Foundry executives very often have to do a certain amount of designing themselves and, should this occur, the latest booklet published by Redpath, Brown & Company, Limited, of 2, St. Andrew Square, Edinburgh, will be of infinite use, as it gives in condensed form the safe loads carried by beams, pillars and rivets.

WHILST TRAVELLING with a party of his staff on business to Todhead Lighthouse, near Stonehaven, Mr. James Steven, director of Messrs. Steven & Struthers, Limited, engineers and brassfounders, Glasgow, sustained a broken collar bone and other severe injuries when a motor-lorry ran into the car in which the party was travelling. Mr. Hugh Hodge, foreman engineer, was killed outright, and Mr. Allan Ritchie, chief draughtsman, died after removal to the infirmary in Perth. Mr. George Hillan, an engineer, was seriously injured about the head and body and was taken to Perth Infirmary in a critical condition, and Mr. Robert Young, a partner of a firm of contractors, who accompanied the party, was also detained in the infirmary suffering from serious head and body injuries.

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Tough	29	5	0
Best selected	29	15	0
Sheets	58	0	0
India	40	10	0
Wire bars	31	0	0
Ingot bars	31	0	0
H.C. wire rods	34	0	0
Off. av. cash, October	26	15	9 21/40
Do., 3 mths., October	27	1	8 21/40
Do., Sttlmnt., October	26	15	11 17/20
Do., Electro, October	29	17	6
Do., B.S., October	29	15	10
Do., wire bars, October	30	5	5 5/24
Solid drawn tubes			9½d.
Brazed tubes			9½d.
Wire			6d.

BRASS

Solid drawn tubes	8¾d.
Brazed tubes	10¼d.
Rods, drawn	8½d.
Rods, extd. or rlld.	4¼d.
Sheets to 10 w.g.	7d.
Wire	7½d.
Rolled metal	6½d.
Yellow metal rods	4½d.
Do. 4 × 4 Squares	5½d.
Do. 4 × 3 Sheets	5½d.

TIN

	£	s.	d.
Standard cash	229	15	0
Three months	229	15	0
English	229	17	6
Bars	231	17	6
Straits	230	17	6
Australian (nom.)			—
Eastern	231	5	0
Banca	231	5	0
Off. av. cash, October	230	13	7 1/40
Do., 3 mths., October	228	16	9 1/20
Do., Sttlmt., October	230	13	8 7/20

SPELTER

	£	s.	d.
Ordinary	11	18	9
Remelted	13	0	0
Hard	10	10	0
Electro 99.9	14	11	3
English	13	0	0
India	12	0	0
Zinc dust	17	0	0
Zinc ashes	3	0	0
Off. aver., October	12	5	8 1/3
Aver. spot, October	12	4	4 4/15

LEAD

	£	s.	d.
Soft foreign ppt.	10	15	0
Empire (nom.)	11	16	3
English	12	15	0
Off. average, October	10	9	1 1/3
Average spot, October	10	7	2 3/13

ALUMINIUM

Ingots	£100 to £105
Wire	1/1 to 1/9 lb.
Sheet and foil	1/2 to 2/9 lb.

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	23	10	0
Do., V.M. ex whse.	22	17	6
Rods	26	12	6

ANTIMONY

	£	s.	d.
English	65	0	0
Chinese, ex-whse.	60	0	0
Crude		—	

QUICKSILVER

Quicksilver . 11 2 6 to 11 10 0

FERRO-ALLOYS AND STEEL-MAKING METALS

Ferro-silicon—	
25%	8 17 6
45/50%	13 0 0
75%	18 7 6
Ferro-vanadium—	
35/50	12/8 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free	5/6 lb. Mo.
Ferro-titanium—	
23/25% carbon-free	9d. lb.
Ferro-phosphorus, 20/25%	£14 10 0
Ferro-tungsten—	
80/85%	3/- lb.
Tungsten metal powder—	
98/99%	3/3 lb.
Ferro-chrome—	
2/4% car.	29 15 0
4/6% car.	23 0 0
6/8% car.	21 12 6
8/10% car.	21 12 6
Ferro-chrome—	
Max. 2% car.	34 0 0
Max. 1% car.	38 15 0
Max. 0.70% car.	42 0 0
70%, carbon-free	10d. lb.
Nickel—99.5/100%	£200 to £205
"F" nickel shot	£184 0 0
Ferro-cobalt, 98/99%	5/3 lb.
Metallic chromium—	
96/98%	2/5 lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to £11 5 0
76/80% packed	£11 15 0 to £12 5 0
76/80% export	(nom.) £9 15 0
Metallic manganese—	
94/96% carbon-free	1/2 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten 2s. 0d.
Finished bars, 18% tungsten 2s. 9d.
Per lb. net, d/d buyers' works.

Extras—
Rounds and squares, 3 in. and over 4d. lb.
Rounds and squares, under ½ in. to ¼ in. 3d. lb.
Do., under ¼ in. to ⅛ in. 1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in. 3d. lb.
Do., under ¼ in. × ¼ in. 1/- lb.
Bevels of approved sizes and sections 6d. lb.
Bars cut to length, 10% extra.

SCRAP

	£	s.	d.		£	s.	d.
South Wales—							
Heavy steel	2	15	0	to	2	16	0
Bundled shrngs.					2	7	6
Mixed iron and steel	2	10	0	to	2	12	0
Heavy cast iron	2	7	6	to	2	10	0
Good machinery	2	12	6	to	2	15	0
Cleveland—							
Heavy steel	2	10	0	to	2	12	6
Steel turnings					1	15	0
Cast-iron borings					1	5	0
Heavy forge					2	10	0
W.I. piling scrap					2	5	0
Cast-iron scrap	2	11	6	to	2	13	6
Midlands—							
Light cast-iron scrap					2	7	6
Heavy wrought iron					3	0	0
Steel turnings, f.o.r.					1	14	0
Scotland—							
Heavy steel					2	10	0
Ordinary cast iron					2	12	6
Engineers' turnings					1	19	0
Cast-iron borings					1	17	6
Wrought-iron piling					2	11	3
Heavy machinery					2	16	3

London—Merchants' buying prices, delivered yard.

	£	s.	d.
Copper (clean)	24	0	0
Brass	16	10	0
Lead (less usual draft)	10	0	0
Tea lead	7	0	0
Zinc	9	0	0
New aluminium cuttings	66	0	0
Braziery copper	19	0	0
Gunmetal	23	0	0
Hollow pewter	150	0	0
Shaped black pewter	112	0	0

PIG-IRON

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	70/-
Foundry No. 3	67/6
,, at Falkirk	67/3
,, at Glasgow	70/3
Foundry No. 4	66/6
Forge No. 4	66/6
Hematite No. 1	69/-
Hematite M/Nos.	68/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	72/6
,, d/d Birm.	84/6
Malleable iron d/d Birm.	115/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	67/-
,, No. 3 fdry.	71/-
Northants forge	63/6
,, fdry. No. 3	67/6
,, fdry. No. 1	70/6
Derbyshire forge	67/-
,, fdry. No. 3	71/-
,, fdry. No. 1	74/-
Scotland—	
Foundry No. 1, f.o.t.	72/6
,, No. 3, f.o.t.	70/-
Hem. M/Nos. d d	71/-
Sheffield (d/d district)—	
Derby forge	64/6
,, fdry. No. 3	68/6
Lincs forge	64/6
,, fdry. No. 3	68/6
E.C. hematite	81/6
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	74/-
Staffs fdry. No. 3	74/-
Northants fdry. No. 3	72/6
Cleveland fdry. No. 3	74/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	82/6
Clyde, No. 3	82/6
Monkland, No. 3	82/6
Summerlee, No. 3	82/6
Eglinton, No. 3	82/6
Gartsherrie, No. 3	82/6
Shotts, No. 3	82/6

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.)	9	12	6	to	9	15	0
Nut and bolt iron	7	10	0	to	8	0	0
Hoops	10	10	0	and up.			
Marked bars (Staffs) f.o.t.					12	0	0
Gas strip	10	10	0	and up.			
Bolts and nuts, ½ in. × 4 in.					14	0	0
Steel—							
Plates, ship, etc.	8	15	0	to	8	17	6
Boiler plts.					9	7	6
Chequer plts.					10	7	6
Angles					8	7	6
Tees					9	7	6
Joists					8	15	0
Rounds and squares, 3 in. to 5½ in.					9	7	6
Rounds under 3 in. to ⅜ in. (Untested)					8	12	0
Flats—8 in. wide and over					8	12	6
,, under 8 in. and over 5 in.					8	17	6
Rails, heavy	8	5	0	to	8	10	0
Fishplates	12	5	0	to	12	10	0
Hoops (Staffs)					9	7	0
Black sheets, 24g. (4-t. lots)					10	10	0
Galv. cor. shts. (,,)					13	0	0
Galv. flat shts. (,,)					13	10	0
Galv. fencing wire, 8g. plain					14	10	0
Billets, soft	5	10	0	and up.			
Billets, hard	6	17	6	to	7	2	6
Sheet bars	5	0	0	to	5	7	6
Tin bars	5	2	6	to	5	7	6

PHOSPHOR BRONZE

	Per lb. basis.
Strip	9d.
Sheet to 10 w.g.	10d.
Wire	11½d.
Rods	10d.
Tubes	13d.
Castings	10½d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	20.26
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	14.50
Basic, Valley	18.00
Bessemer	20.76
Malleable, Valley	18.50
Grey forge, Valley	18.00
Ferro-mang. 80%, seaboard	85.00
O.-h. rails, h'y, at mill	36.37½
Billets	27.00
Sheet bars	28.00
Wire rods	38.00
	Cents.
Iron bars, Chicago	1.80
Steel bars	1.80
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.70
Steel hoops	2.10
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	3.10
Wire nails	2.60
Plain wire	2.30
Barbed wire, galv.	3.00
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	25/- to 30/-
,, furnace	19/- to 20/-
Durham foundry	20/- to 25/-
,, furnace	17/6
Midlands, foundry	—
,, furnace	—

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box	18/2 to 18/6
,,	28×20 ,,	36/4 to 37/-
,,	20×10 ,,	26/- to 26/6
,,	18¾×14 ,,	18/9 to 19/-
C.W.	20×14 ,,	16/- to 16/6
,,	28×20 ,,	34/- to 35/-
,,	20×10 ,,	23/3 to 23/6
,,	18¾×14 ,,	16/3 to 16/6

SWEDISH CHARCOAL IRON & STEEL

Pig-iron	£6	0	0	to	£7	0	0
Bars-hammered, basis	£16	0	0	to	£16	10	0
Bars and nail-rods, rolled, basis	£15	15	0	to	£16	0	0
Blooms	£10	0	0	to	£12	0	0
Keg steel	£30	0	0	to	£31	0	0
Faggot steel	£18	0	0	to	£23	0	0
Bars and rods dead soft, st'l	£10	0	0	to	£12	0	0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

		£	s.	d.	
Nov. 22	..	26	13	9	inc. 2/6
,, 23	..	27	0	0	,, 6/3
,, 26	..	27	2	6	,, 2/6
,, 27	..	27	10	0	,, 7/6
,, 28	..	27	10	0	No change

Electrolytic Copper

		£	s.	d.	
Nov. 22	..	29	17	6	inc. 2/6
,, 23	..	30	0	0	,, 2/6
,, 26	..	30	0	0	No change
,, 27	..	30	10	0	inc. 10/-
,, 28	..	30	10	0	No change

Standard Tin (cash)

		£	s.	d.	
Nov. 22	..	228	2	6	dec. 7/6
,, 23	..	228	5	0	inc. 2/6
,, 26	..	228	12	6	,, 7/6
,, 27	..	228	15	0	,, 2/6
,, 28	..	229	15	0	,, 20/-

Tin (English ingots)

		£	s.	d.	
Nov. 22	..	228	7	6	dec. 10/-
,, 23	..	228	7	6	No change
,, 26	..	228	17	6	inc. 10/-
,, 27	..	228	17	6	No change
,, 28	..	229	17	6	inc. 20/-

Spelter (ordinary)

		£	s.	d.	
Nov. 22	..	11	16	3	No change
,, 23	..	11	13	9	dec. 2/6
,, 26	..	11	16	3	inc. 2/6
,, 27	..	11	17	6	,, 1/3
,, 28	..	11	18	9	,, 1/3

Spelter (Electro, 99.9 per cent.)

		£	s.	d.	
Nov. 22	..	14	7	6	dec. 1/3
,, 23	..	14	6	3	,, 1/3
,, 26	..	14	10	0	inc. 3/9
,, 27	..	14	11	3	,, 1/3
,, 28	..	14	11	3	No change

Zinc Sheets (English)

		£	s.	d.	
Nov. 22	..	23	10	0	No change
,, 23	..	23	10	0	,, ,,
,, 26	..	23	10	0	,, ,,
,, 27	..	23	10	0	,, ,,
,, 28	..	23	10	0	,, ,,

Lead (English)

		£	s.	d.	
Nov. 22	..	12	10	0	No change
,, 23	..	12	10	0	,, ,,
,, 26	..	12	10	0	,, ,,
,, 27	..	12	15	0	inc. 5/-
,, 28	..	12	15	0	No change

AVERAGE MONTHLY PRICES OF RUBIO ORE (MIDDLESBROUGH).

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1896	0 12 6	0 12 6	0 12 9	0 12 9	0 12 9	0 12 7	0 12 9	0 12 9	0 12 9	0 13 6	0 15 0	0 14 9	0 13 1
1897	0 15 3	0 15 6	0 15 3	0 15 0	0 14 0	0 14 3	0 14 3	0 14 0	0 14 0	0 15 0	0 14 3	0 15 3	0 14 8
1898	0 15 0	0 14 4	0 14 9	0 14 6	0 15 0	0 15 0	0 14 0	0 14 0	0 14 0	0 14 9	0 15 0	0 14 9	0 14 7
1899	0 15 0	0 15 3	0 15 6	0 15 6	0 15 9	0 16 0	0 17 6	0 18 0	0 17 9	0 18 0	0 19 0	1 0 0	0 16 11½
1900	1 1 0	1 0 6	1 1 0	1 0 9	1 1 0	1 1 0	1 1 3	1 1 6	1 1 3	1 1 3	1 0 0	0 18 0	1 0 8½
1901	0 17 6	0 16 0	0 15 0	0 14 6	0 15 6	0 15 9	0 14 9	0 15 3	0 15 9	0 15 9	0 15 9	0 15 9	0 15 7½
1902	0 15 6	0 15 0	0 16 0	0 16 0	0 15 6	0 15 3	0 15 6	0 16 0	0 16 0	0 16 0	0 15 9	0 15 6	0 15 8½
1903	0 15 6	0 16 0	0 16 6	0 16 3	0 16 3	0 16 10	0 15 9	0 15 6	0 15 6	0 14 9	0 14 9	0 15 1	0 15 8
1904	0 14 9	0 15 3	0 15 1	0 15 4	0 15 3	0 15 0	0 14 5	0 14 6	0 14 6	0 14 6	0 14 6	0 14 7	0 14 9½
1905	0 15 3	0 15 6	0 15 0	0 15 3	0 15 6	0 15 6	0 15 6	0 15 6	0 16 6	0 18 6	0 18 9	0 18 9	0 16 3½
1906	1 0 0	1 1 6	1 0 0	1 0 0	0 19 6	1 0 0	0 19 6	0 19 4	1 0 6	1 1 6	1 1 9	1 3 6	1 0 7
1907	1 3 6	1 2 6	1 2 6	1 2 0	1 1 6	1 2 3	1 2 3	1 2 0	1 1 0	0 19 0	0 18 9	0 17 6	1 1 2½
1908	0 16 6	0 15 0	0 15 6	0 15 6	0 15 3	0 15 0	0 15 0	0 14 9	0 15 0	0 16 0	0 16 0	0 16 0	0 15 6½
1909	0 15 9	0 16 3	0 16 0	0 16 0	0 16 3	0 16 6	0 16 0	0 16 0	0 17 0	0 17 0	0 17 6	0 17 6	0 16 6
1910	1 0 4	1 0 9	1 0 9	1 0 9	1 0 9	1 0 9	1 0 9	1 0 3	1 0 3	1 0 6½	1 1 3	1 1 5	1 0 9½
1911	1 2 2½	1 2 6	1 2 6	1 1 11½	1 0 11½	0 19 6	0 19 0	0 19 0	0 19 1½	0 19 6	1 0 0½	1 1 6½	1 0 7½
1912	1 2 3	1 2 6	1 2 6	1 1 1½	1 1 6	1 1 6	1 1 6	1 2 3	1 2 6	1 3 0	1 3 0	1 2 11	1 2 2½
1913	1 2 9	1 2 2	1 1 7½	1 1 6	1 0 8½	1 0 0	1 0 0	1 0 0	0 19 10½	0 19 1½	0 19 0	0 19 0	1 0 8½
1914	0 18 7½	0 18 0	0 18 0	0 17 9	0 17 6	0 17 6	0 17 1½	0 19 7½	0 18 11½	0 17 10½	0 18 7½	1 1 0½	0 18 5½
1915	1 7 7½	1 8 6	1 9 3	1 10 2½	1 8 6	1 6 4	1 5 10½	1 6 0	1 6 10½	1 10 8½	1 13 0	1 17 10	1 9 1½
1916	1 18 6	2 0 1½	2 2 6½	2 0 6½	1 15 0	1 16 3	1 18 0	1 18 0	1 18 0	—	—	—	—
1917	} Price Fixed												
1918													
1919	—	—	—	—	2 5 7½	2 14 4½	2 16 4½	2 14 0	2 13 4½	2 13 0	2 12 7½	2 11 9	—
1920	2 17 0	3 7 9	2 15 6	3 6 7	3 0 0	2 15 0	2 14 0	2 9 9	2 7 6	2 11 0	2 12 3	2 10 0	2 15 0
1921	2 1 0	2 0 1½	1 18 3	1 17 6	1 17 6	1 17 6	1 17 6	1 5 0	1 8 9½	1 7 9	1 7 0	1 7 0	1 13 8½
1922	1 6 7½	1 5 10½	1 6 11	1 7 0	1 7 0	1 7 0	1 5 3	1 4 9½	1 4 2½	1 3 3½	1 2 6	1 2 3	1 5 2½
1923	1 2 9½	1 4 6½	1 5 2	1 4 8½	1 4 6	1 4 0	1 3 6	1 3 0	1 3 0	1 3 0	1 3 2½	1 4 9	1 3 10½
1924	1 4 2½	1 4 0	1 4 0	1 3 7½	1 3 8½	1 3 6	1 2 11	1 2 6	1 2 1½	1 1 7½	1 2 3	1 2 6	1 3 1
1925	1 2 6	1 2 1½	1 2 0	1 2 0	1 2 0	1 1 6	1 0 6	1 0 0	1 0 0	1 0 0	1 0 3	1 0 10½	1 1 1½
1926	1 1 1½	1 1 6	1 1 6	1 1 3½	1 1 3	1 1 5½	1 1 6	1 1 6	1 1 0	1 1 6	1 1 6	—	1 1 4½
1927	1 2 1½	1 2 3	1 2 1½	1 2 0	1 2 0	1 2 0	1 1 7½	1 1 0	1 1 0	1 1 0	1 1 0	1 1 0	1 1 7½
1928	1 1 0	1 1 1½	1 1 11	1 2 4½	1 2 6	1 2 6	1 2 6	1 2 6	1 2 6	1 2 6	1 2 6	1 2 6	1 2 2½
1929	1 2 6	1 2 6½	1 2 11½	1 3 0	1 3 0	1 3 2½	1 4 0	1 4 8½	1 4 7½	1 4 6	1 4 6	1 4 3	1 3 7½
1930	1 3 3½	1 2 6	1 1 9	1 1 6	1 0 10½	1 0 0	1 0 0	0 19 6	0 19 0	0 17 4½	0 16 4½	0 16 4½	0 19 10½
1931	0 16 1½	0 16 0	0 16 0	0 15 11½	0 15 4½	0 15 0½	0 14 10½	0 14 3½	0 14 6	0 16 8½	0 17 0½	0 16 6	0 15 9
1932	0 16 6	0 16 6	0 16 3	0 15 6	0 15 4½	0 15 0	0 14 11	0 14 8½	0 14 6	0 14 6	0 14 9	0 15 1	0 15 3½
1933	0 15 6	0 15 3	0 15 3	0 15 3	0 15 3	0 15 6	0 15 6	0 15 6	0 15 6	0 15 11½	0 16 6	0 16 6	0 15 7½
1934	0 16 6	0 17 6	0 16 9	0 16 6½	0 16 8½	0 16 9½	0 17 0	0 17 0	0 17 0	0 17 0	—	—	—

WILLIAM JACKS & COMPANY,
WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.
13, RUMFORD STREET, LIVERPOOL.

PIG

IRON

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,
CENTRAL CHAMBERS, 93, HOPE ST., GLASGOW, C.2.
ZETLAND ROAD, MIDDLESBROUGH.

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(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED

CLERK, aged 22, used to costs, stock, desires change for experience.—Box 970, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

TO Iron, Steel, or Malleable Founders.—Gentleman (Scot), 20 years' commercial and technical training, with sound established connection all Scotland and N.E. England, open to represent first-class firm. — Box 974, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

ESTIMATING Clerk wanted, used to estimating weights from blueprints for both small and large cast-iron castings for motor and other trades, and also judging best methods of making and fixing prices for coremaking, moulding, etc.—Apply, stating age, experience and salary required, otherwise application not considered, Box 962, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY in South Midlands with an output of 150/200 tons repetition grey-iron castings per week, require General Manager; must be capable of taking complete control and conversant with to-day's costs and selling prices. Permanent and progressive job for the right man. Send full particulars past experience in absolute confidence, stating age and salary required.—Apply, Box 976, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

REPRESENTATIVE required for sale of Non-Ferrous Alloys in all forms. Age about 28. Good appearance and education. Must have engineering experience.—Write, "T. H.," c/o J. W. VICKERS & COMPANY, LIMITED, 24, Austin Friars, E.C.2.

REPRESENTATIVES required throughout Great Britain for marketing chemical device applied by metal and iron founders. Liberal commission only.—Write, Box ZX 175, c/o DEACONS, 5, St. Mary Axe, London, E.C.3.

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